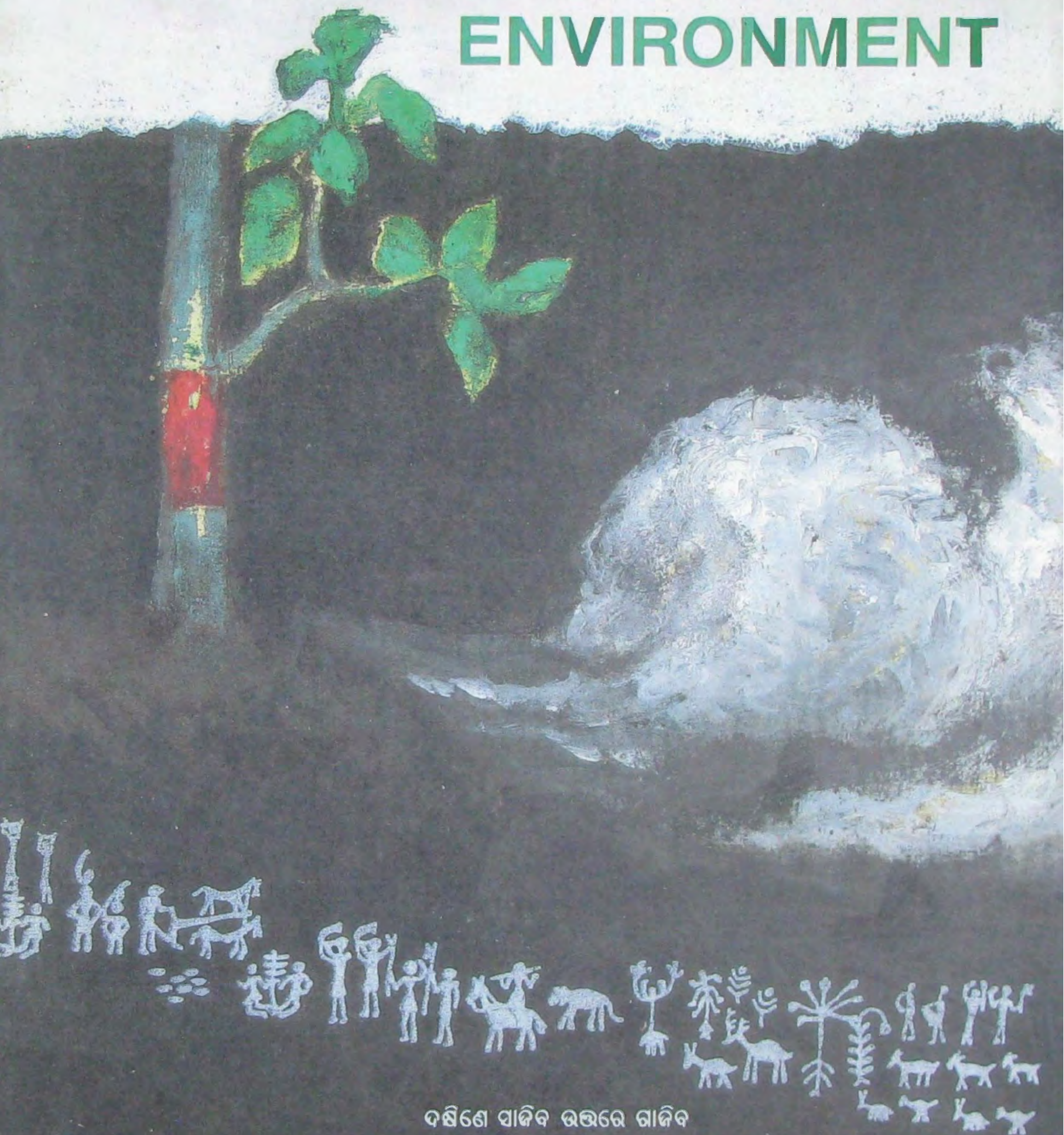
STATE OF ORISSA'S ENVIRONMENT



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ପୂର୍ବେ ନରହିବେ କେହି
ଝାଡ଼ବାଡ଼ ଧରି ରହିଥିବେ ଯିଏ
କୁଳକୁ ବିହନ ସେହି

STATE OF ORISSA'S ENVIRONMENT
- A CITIZEN'S REPORT



COUNCIL OF PROFESSIONAL SOCIAL WORKERS (CPSW)
BHUBANESWAR



The literacy translation of the 'Mallka' concept used on the cover reads like : If (Clouds) will form in the South and 'Pour' in the North - there will be no one in the East - only the ones who stay close to the forest/vegetation will remain as 'stock' to the posterity. 'Mallka' - 'songs' usually song at 'Trinath Mela' joints - worshiping place of Bramha, Bishnu, Maheswar often seen under roadside Banyan trees.

TO THE VICTIMS OF ENVIRONMENTAL STRUGGLES FOR SURVIVAL & HUMAN RIGHTS

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CONTENTS

STATE OF ORISSA'S ENVIRONMENT

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We reminiscences the encouragement and support of late Dr.B.N.SAHOO who had great understanding and contribution in the field concerning Orissa's Environment. His works and publications relating to environment were first of its kind to enrich people's knowledge and understanding.

INTRODUCTION

The close link between the Environment and Sustainable Development is widely realised today. Poverty and marginalisation of rural poor is increasing as a result of Environmental degradation during last few decades in case of Orissa. Always, it is the poor who is blamed for environmental degradation who only takes a bunch of twigs or clears a patch of forests just for survival. But, there is hardly any comprehensive analysis of our Environment and Eco-systems, its degradation and management from a wholistic and people's perspective. More often, the interdependence of flora -fauna - people and other Natural elements is not properly understood and the imperical knowledge of the people is not at all taken into account. Also, community dynamics, relationships and strength as well as socio-cultural values which are crucial for management of the eco-systems are not given any importance. On the other hand, Eco-systems, owned and managed by Government are coming under serious threats and some of the very fragile ones such as Chilika, Bhitarakanika, Mahendragiri, Similipal and so on are taken for exploitation to maximise revenue and export. People had their own intelligent way to live in these eco-systems and self-regulate their behaviour in which the damage was not visible. But, capital intensive and profit oriented development model which only benefits a few has wide repurcasions on these eco-systems and the rural masses. Prawn Farming in Chilika and the East coast, Fishing Jetty in Bhitarakanika, Mechanised fishing on sea, Hotel-Beach resort complex on the coast, mining in most of the rich forests - water - wildlife and Tribal dominated areas, Industries, plants, railways and roads in those areas, settlements and extension of urbanisation, pollution of water, air, land and vegetation, repeated displacements of people, monoculture in every sphere of life, Commercial Plantations, loss of bio-diversity, Green Revolution using chemical fertilisers and pesticides as well as HYV seeds are all said to be "Development" which will make Orissa prosperous. But in doing all these things for so many years (pre & post-British period), what has happened ? Have people really developed or have become poorer? We fell this effort has tried to explore this myth. We tried to collect all available informations, reports, studies and observed from villages as well as organised meetings, seminars to examine these issues without keeping any bias in view.

The other question which was asked to us quite often what is the alternative ? Our extensive travel to the villages and keen observation of the life styles of the people, their occupational skills and practices, community efforts to solve their problems and manage their eco-systems was very much inspiring and educative. Earlier, even we were thinking whether the communities can manage the local resources in the long-run ! To understand this aspect, we have tried our best and documented under various subjects. The environmental problems which looked to us too complex and its management too complicated, and challenging, was found to be very simple and achievable at the community level with their full access & control, not just "participation" in the conventional sense, was the learning we made in this process.



In this report, Natural Resources such as Land, Forests, Natural Heritage and Eco-systems, Atmosphere and Water are discussed in the beginning chapters in which we have analysed the extent, types, present state, process and forces of degradation, history of managements, people's participation, role of NGOs, alternative approach and policy issues related to sustainability and Equity etc.

Termed as "Natural Calamities", Droughts and Floods occur almost every year in Orissa. The socio-economic life of coastal region as well as west and south Orissa is getting ruined day by day. Food scarcity, hunger, migration, diseases and distress conditions pose a serious environmental and socio-economic problem for the people living in these areas. Earlier, people knew how to live with these disasters and developed mechanisms to cope with them. But, introduction of solutions from outside has manifold the problem and misery of the people. Hence, we tried to understand the situation, impact of development measures, successful experiments and local initiatives in these cases. In controlling both these problems, we found the measures taken have not been very successful scientific and sustainable apart from the equity issue.



In the following chapters, certain basic needs of the people such as Animal Resources (for milk, dung, draught power), Energy (cooking purpose) and Housing are directly depended on the bio-mass production of the regions. Environmental degradation has added to the misery of women, children, rural poor and rural artisans whose traditional occupations were based on these common bio-mass resources. There exists a lot of possibilities and potentialities in different agro-climatic, geographical and environmental regions. Conservation and Development efforts need to be area & culture specific. This issue has been taken further in the chapter on Community Management of Common Resources. In the chapters on Mineral Resources and Industrial Pollution, we have tried to describe the present situation and create a debate with regard to the "growth oriented" and "export oriented" economic model. Orissa's poverty situation and history was found to be quite interesting, as discussed in chapter Orissa's Poverty, Development & Struggle for Survival. Large scale displacements, lack of Rehabilitation and Resettlement, and displacement of rural poor from their subsistence as a everyday phenomenon is found to be the main cause of increasing poverty in our rural areas.

Tribals are a unique people who constitute about 23 percent of Orissa's population. Their life, culture and survival is closely linked to the Nature. In certain areas of Orissa, their population is of high percentage. But, they are finding themselves helpless and powerless, who were once upon known for their militancy, those who know how to live and fight with the tiger and other wild-animals. Being resource rich regions, these people are the worst victims of the development project. Hence, in the chapter on Tribal People, we have analysed these aspects as well as their traditional rights, Tribal Development and Tribal Autonomy.



As a whole this document presents a very comprehensive picture of the state of Orissa's Environment. The documentation work started in mid-1990. There was an effort to make it a collective work, so as to mobilise expertise and resources. A state level meet of Environmentalists and Social Activists was organised on 30-31 July, 1990 at Bhubaneswar where this proposal was discussed. Few people volunteered to take responsibility and CPSW agreed to provide the necessary infrastructural facilities and coordinate the work.

Then, the work went through many phases. Some of the people who took responsibility could do their work. But, for most of the people it was difficult to spend so much of time, required for the task. CPSW collected informations, reports, books articles, newspaper clippings

research works and Government records from all available sources. Data compilation and analysis went on since then. It was very very difficult to collect informations from the Government sources. Days were spent to collect just one report or a single information. We wrote several letters to NGOs to send us informations, case studies and reports. The replay was good, but not the result. So, we made some efforts to document their experiments and achievements.



On many issues and aspects, we tried to get a clear-cut perspective or direction. Then, we organised few seminars, workshops and participated in such events as well as in few people's movements which gave us further insight. Then, our work in the field as well as a team spending few days in villages of different agro-climatic and bio-mass region really was very useful to generate informations, study community management systems, community dynamics and values. Such village Eco-camps and Rural Rapid Appraisals helped to concretise certain things and exposed certain myths. Then, we used the Satellite Imagery interpretation data which we found more reliable, though there are limitations.

The Original plan was to publish this report by June, 1992. But, we found the work in complete and wanted to take more time. Generation of more and more reports and advancement in environmental knowledge forced us to go for further improvement. As the report got delayed, data updating became necessary. New district formations took place in Orissa starting from April, 1, 1993. So updating of certain informations took us quite some time.

At last, perspective editing and technical editing was done. Language editing took little more time so as to make the presentation more readable and less technical as well as academic. Photography, Preparation of Maps, page-layouts, proof correction etc. for such a voluminous work was not an easy thing to manage in such a short time. Of course, many other things has to go on simultaneously which helped us to add to its quality and usefulness, but this work got delayed.

Many organisations and individuals have lost their hope in seeing this work as a reality. But, we never lost our confidence. It was not that easy as we thought at the time of planning. We express our sincere thanks to our family members, staff of CPSW and other organisations for their cooperation and tolerance. We had to work very hard for such as long-time.

It will be our great pleasure, if the report is useful for those who are making their small efforts to survive with the nature and if it contributes to whatever extent to the environmental movement taking place in this State, Nation and Earth for a better future.

MANOJ K. PRADHAN
Editor

STATE OF ORISSA'S ENVIRONMENT

The following Organisations have extended their cooperation to this work :

NGOs :

ABLE - Kendrapada, ABP - Kamakshyanagar, ACM - Rasagovindpur, Adivasi Vikash Samiti - Keonjhar, Agragamee - Kashipur, ASK - Cuttack, Balasore Zilla Peasants and Labour Organisation - Balasore, Bharat - Mahakalapada, BOJB - Kesharpur, BS - Komna, CENDERET - Bhubaneswar, Chilika Bachaoo Andolan - Puri, CSS - Paikmal, CYSD - Bhubaneswar, CZHASSY - Derabish, DAG - Angul, GASS - Orissa, Gaunli Bichar - Bhubaneswar, GJS - Brahmagiri, GMS - G.Udayagiri, GPC - Bhubaneswar, Gram Vikas - Mohuda, GUC - Gania, Indravati Gana Sangharsha Parishad - Nowarangpur, Jaya Bharati Sathi Samaj - Derabish, JSS - Khariar, J.V.K. - Cuttack, Lipica - Berhampur, Lokdrusti - Khariar, NAG - Nayagarh, ODAF, Orissa, OECS - Burla, OES - Bhubaneswar, OVHA - Bhubaneswar, PIPAR - Dhenkanal, PREM - Berhampur, Project Swarajya - Cuttack, REC - Udala, RES - Rourkela, Samannoya - Sunabeda (Nawapara), Seva Bharati - Tumudibandha, SHED - Kantamal, SSS - Sinapalli, TSRD - Malkangiri, VIKALPA - Kantabanjhi, VISWASS - Khariar Road, WIDA - Koraput, Yojana - Puri.

Academy of Gandhian Studies - Hyderabad, CED - Bombay, CSE - New Delhi,

GOVT. & OTHER ORGANISATIONS :

CE - Irrigation, Orissa, CENSUS Office - Bhubaneswar, Directorate of Animal Husbandry - Cuttack, Directorate of S.F. Project, Bhubaneswar, EPA - Bhubaneswar, F & E Deptt. Govt. of Orissa, ISO/SWED Forest Project - Bhubaneswar, OLIC - Bhubaneswar, OMFED - Bhubaneswar, OREDA - Bhubaneswar, ORSAC - Bhubaneswar, OSPCB - Bhubaneswar, PCCF - Bhubaneswar, The Samaj - Cuttack, The Sambad - Bhubaneswar, Wildlife Warden - Bhubaneswar.

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LAND

Orissa looses 364.980 million metric tonnes of top soil every year while 1 cm of this takes thousand years to form. Predominantly a hilly terrain and 3/4 of its total land being sloppy, more than 52 percent of the State's land are in the grip of erosion. The annual average rainfall of 1400 cm, the kind of soil types and texure, absence of adequate conservation measures, massive deforestation, cultivation of unbunded slop and uplands leads to fast soil erosion and land degradation. Specially, the marginal lands cultivated by the poor people are fast degrading. The rights over 5 lakh acres (approximately) shifting cultivated land is not settled in favour the cultivators (mostly tribals) and by preventing the practice in new areas forces them to cultivate continuously on same lands for longer periods leading to degradation. Scientific cultivation and investment on such lands is not allowed. Thus, neither the forest is conserved nor the soil. Ultimately the tribals suffers and becomes victim of the forest officials. All this is resulting in regular drought conditions with slightest fluctuation in rainfall and floods in every alternative year as the river beds, nalas and drains get silted up. Above 4 lakhs 99 thousand hectares of good fertile lands in the coastal plains have been water logged, saltenated and sand casted. Indiscriminate and large scale diversion of cultivated lands for industrial, mining and urbanisation purposes in the absence of a proper land use planning, submergence of fertile lands by reservoirs and land alienation are putting heavy pressure on the limited resource. The problem is being further aggravated by the unproductivity and consequent low yield rate of land. Unscientific agricultural practices in the name of a green revolution, introduction of HYV seeds, use of chemical fertilisers and pesticides are proving harmful to the soil. Simultaneously, the emphasis on commercial crops, and the commercialisation of agricultural resources/products puts at stake, the subsistence of the common man as well as the food security of the country.

FOOD SECURITY

Orissa, is heading towards a food crisis. The State requires an additional production of 99 thousand tonnes of cereals every year to meet the Planning Commissions norm of providing 225 kgs of cereals per person per year. The situation has become more crucial with the constant increase in population that has risen steadily from 10.3 million in 1901, 17.0 million in 1961 to 31.5 million in 1991. This increase of 5 lakhs every year does not augur well for the state implying that new mouths have to be fed, while the gnawing fact is that, there is a growing deficit of cereals, fats, pulses and oils.

The area under cereals production has declined from 4975 thousand hectares to 4788 during the period 1972-73 and 1991-92, inspite of an increase of 1577 thousand hectares of land under cultivation during the same period. Millets etc. which are the staple food of the majority of poor people are not produced adequately either due to land degradation, change of cropping pattern or land alienation. The total land cultivated in this category has been drastically reduced to 240 thousand hectares from 499 during the period mentioned earlier with a reduction in production by 223 thousand tonnes. On the other hand, cultivation of cash crops like sugar cane and tobacco has increased by 637 and 994 per cent respectively, in the same period. The trends in food grains production and land degradation as well as diversion of croplands for non-agricultural purposes is a serious problem which needs to be taken into account in our planning process.

Table - 1 : Changes in Food Production

Cereals	1972-73 Area ('000 hts)	1972-73 Production ('000 tons)	1972-73 Yield rates (Qt/Ht)	1991-92 Area ('000 ht)	1991-92 Production ('000 tons)	1991-92 Yield rates (Qt/Ht)
Rice	4475.9	3983.2	8.90	4547.4	6660	14.65
Others	499.17	388.43	7.78	240.8	165	6.85
Total Cereals	4975.07	4371.6	8.78	4788.2	6825	14.25
Pulses	993.9	488.8	5.20	1258.2	562	4.4?
Oil seeds	369.6	265.5	7.18	5084	284	—
Fiber	7.53	544.6	83.36	562	618	11.00
Sugarcane	30.7	200.1	6.520	191	986	51.63
Tobacco	15.3	13.2	0.862	149	11	—
Other Total cron	—	—	--	1485	1201	—
Grand Total	5622	—	—	67595	9490	—

The figures in Table - 1 show that we have to make a considerable effort to increase the cereal production, though we are to some extent self sufficient in oil seeds and pulse production.

Forests provide a variety of food items to the people, specially the tribals who live in or around forests. Energy also constitutes an important part of the food system which is becoming scarce.

The health and nutrition of the large rural population of the state is directly related to the production of milk, milk products and meat. Besides this, cattle is th e main source of organic manure and draught power.

The cattle population of the state has increased from 1,45,28,251 in 1961 to 2,23,21,705 in 1991. Among other animals the diary animal population has increased from 98 lakhs to 136 lakhs during the same period. These domestic animals almost totally depend on grazing for their feed. Their health and production of milk and meat is very poor due to poor production of grasses and poor maintenance of the grazing and pasture lands.

Fish and aquatic resources, and domestic, livestock and industrial use of water is being severely affected today due to degradation of water bodies & water quality.

LAND USE & LAND DEGRADATION

Fertile and good agricultural, forests and grazing lands as well as water bodies are being diverted indiscriminately for townships, mine related developments, being submerged under huge reservoirs and used for railways and roads etc. It is difficult to assess the exact amount of land that has been diverted for all such uses. The land use table presented below shows the nature of such diversions.

Table - 2 : Change in land use (in '000 hectares)

Type of lands	1972-73 Area	1972-73 % of G.A	1991-92 Area	1991-92 % of G.A
Forest	6088	39.12	5482	35.27
Misc.Uses	619	3.98	855	5.50
Per Pastures	543	3.49	726	4.67
Land not available for cultivation	1333	8.57	1247	8.02
Net area sown	5622	36.17	6337	40.77
Total Cultivated area	6713	43.19	6658	42.84
Cultivable waste	455	2.92	572	3.68
Total Gross area	15540	100.00	15540	100.00

Analysis shows that forest cover in the State has come down to 47,205 sq.kms out of which good cover of above 40% crown density, exists only in 27,349 sq.kms area. The total forest area has come down to 54,000 sq.kms from about 68,000 sq.kms in 1960-91. The major tribal districts of the State such as Koraput, Kalahandi, Phulbani, Keonjhar, Sundergarh and Mayurbhanj have only 27, 23.5, 53.7, 45, 41 and 39 per cent of forest cover respectively of their total geographical area. These were once densely forested.

Though, the amount of permanent pasture and grazing lands shows an increasing trend from 543,000 in 1972-73 to 726,000 hectares in 1991-92, in actuality, most of these lands are encroached for cultivation and the rest have become totally bald, and so underutilised. Whatever grazing area was available and permissible in forests, has become restricted. Eutrophication of lakes (Ansupa and Sar are already dead), is caused by Sedimentation and unscientific catchment management, pollution of all kinds, distribution and utilisation of resources and many such factors. There is a great urgency to manage the water bodies scientifically, so that the ground water will be recharged and the most drought prone areas can produce food sustainably and enhance fish production. Land use changes need to be strictly regulated by the Government which should lay down a clear cut policy on this.

LAND USE MAP OF ORISSA



Source : Agricultural Atlas of India.

Table - 3 : Extent of Degraded Lands

Total cultivated area	72,085.00 sq.kms
Irrigated Area well Protected	(-) 18,450.00
	53,655.00 sq.kms
Other Protected area	(-) 10,275.00 sq.kms
01. Eroded land under Agril.	43,360.00 sq.kms
02. Shifting Cultivation	1,840.00 sq.kms
03. Forest area degraded	32,770.00 sq.kms
04. Water logged	995.00 sq.kms
05. Undulating up lands	9,059.00 sq.kms
06. Salt affected	2,541.00 sq.kms
07. Sandy area	563.00 sq.kms
08. Barren hill ridge	84.00 sq.kms
09. Ravine/Natural Drainage System	1,127.00 sq.kms
Total area	92,339.00 sq.kms


Pix : Ghani Zaman for CPSW.

Degradation and diversion so much of good Fertile lands for non-agricultural purposes will cause food security problem soon.

Crop Lands : All Uplands as well as irrigated command areas are facing serious land degradation. The extent of such unabated degradation is alarming. The most fertile areas of Kalahandi, Bolangir and the coastal areas, considered to be the "Rice Bowl" of the State are under varying degree of stress. Unscientific and irrational management has been promoted for short-term gains instead of looking at its long-term impact and the sustainability of yield.

Agricultural land in the State amounts to 72.085 sq.kms comprising of upland, medium lands and low lands which extend to 29,830 sq.kms., 15,140 sq.kms and 30.115 sq.kms. respectively. Thus it is estimated that 43,360 sq.kms of agricultural land are under the grip of erosion. Out of the total area under cultivation 18,450 sq.kms are under irrigation and as such are well protected. A few leading farmers of the State have protected another 10,275 sq.kms. from the vagaries of nature.

Railway lines, roads and Industrialisation : How much land can we afford to divert ?



Degradation of the Fertile Coastal Lands : The coastal deltaic region extends from Rushikulya in the South East to Subarnarekha in the North-East of Orissa, comprising parts of the old districts of Ganjam, Puri, Cuttack and Balasore. This area known as the "rice-bowl" of the state is now troubled with ecological problems such as salination, land erosion, sand casting, over exploitation of soils etc. and thereby posing a serious threat to the food security of the state. As per remote sensing satellite imagery analysis, the area affected by water logging in Orissa, amounts to 20400 hects. As per sample survey done by the Directorate of Soil Conservation, the waterlogged areas in the ayacuts of four major irrigation systems are as follows :

Mahanadi Stage-II, (Puri Dist), Mahanadi Stage-I (Cuttack dist), Hirakud (Sambalpur & Bolangir dist) and Salandi (Balasore dist) have a total water logged area of 99,469 to 10548 ha. varying in rainy and summer season.

Over Exploitation of Soil : The second threat concerns the possibility of deterioration of some of our best soils which are cultivated intensively in situations of perennial irrigation and multi-cropping. Such deterioration has taken place on account of continued application of large quantities of inorganic fertilizers and pesticides and the depletion of trace elements and other micro-nutrients. The health and fertility of over-worked soils needs to be carefully monitored and maintained through soil testing (at regular intervals) and suitable corrective measures. There are numerous instances of Telgu farmers selling away the over-exploited lands of Baragarh area (i.e. Hirakud Command) and purchasing land in Indravati command. These lands which were once purchased from the local people have now turned waste, requiring huge funds for reclamation.

Uplands : Reaching a Point of no Return : 28 out of the 30 districts of Orissa have a predominantly hilly terrain. Even the coastal districts of Cuttack, Puri, Balasore, Ganjam, have sizable areas under hills. Of the two third of arable lands of the State, sloppy upland/ medium land, are mostly cultivated year after year without taking conservation measures while out of a total arable area of 65,52,000 hectares, 29,83,000 hectares are unbunded sloppy high lands brought under plough. Every year the land is deteriorating further and further reaching a point of no return. The uplands which constitute a sizable bulk of agricultural land have lost organic matter, ability to hold moisture and have lost the top soils & nutrients. Even valuable valley lands have started suffering due to a sudden rush of run off water from the adjoining denuded hills. It is a matter of concern for many that the perennial or semi-perennial streams which fed the valley lands are now discharging less and less flow with progressive denudation of vegetation. This leads to drought. With nothing to hold the soil on the sloppy land, the precious top soils (which nature takes thousands of years to form) is washed down, rendering the hill slopes barren. Thus most of the agricultural high lands of the state are threatened.



Uplands of Koraput Hill region is gradually becoming unproductive.

Pix : Manoj K. Pradhan.

Slope lands need better management. Soil gets washed easily to the stream flowing down.



SOILS OF ORISSA

Soil is the single most important factor for land productivity. Formation of soil is a complex phenomenon and is of varying nature at varying locations. The common type of soils found in the state are grouped as follows :

An area of 30,314 sq.kms, that is 19.51% of the State's geographical area contains problem soils. Besides, according to manual interpretation of ERIS-I imagery estimates, 51.94% of the total surface of Orissa is under the grip of soil erosion, while various types of land erosion is estimated to be of the order of 78.02 lakh hectares.

Table - 4 : SOILS OF ORISSA

The common type of soils found in the State can be grouped under 7 different classes. They are :

Class	Area
1) Red and laterite, red gravelly and loam and gravelly red murum.	15,707 sq.kms.
2) Red sandy loam, red soils, red loam and loam.	35,866 sq.kms.
3) Red and yellow soils/yellow and red soils.	39.069 sq.kms.
4) Red and black/yellow and black soils	19,336 sq.kms.
5) Yellow and brown soils	1,217 sq.kms.
6) Brown soils	1,650 sq.kms.
7) Black soils	17,487 sq.kms.

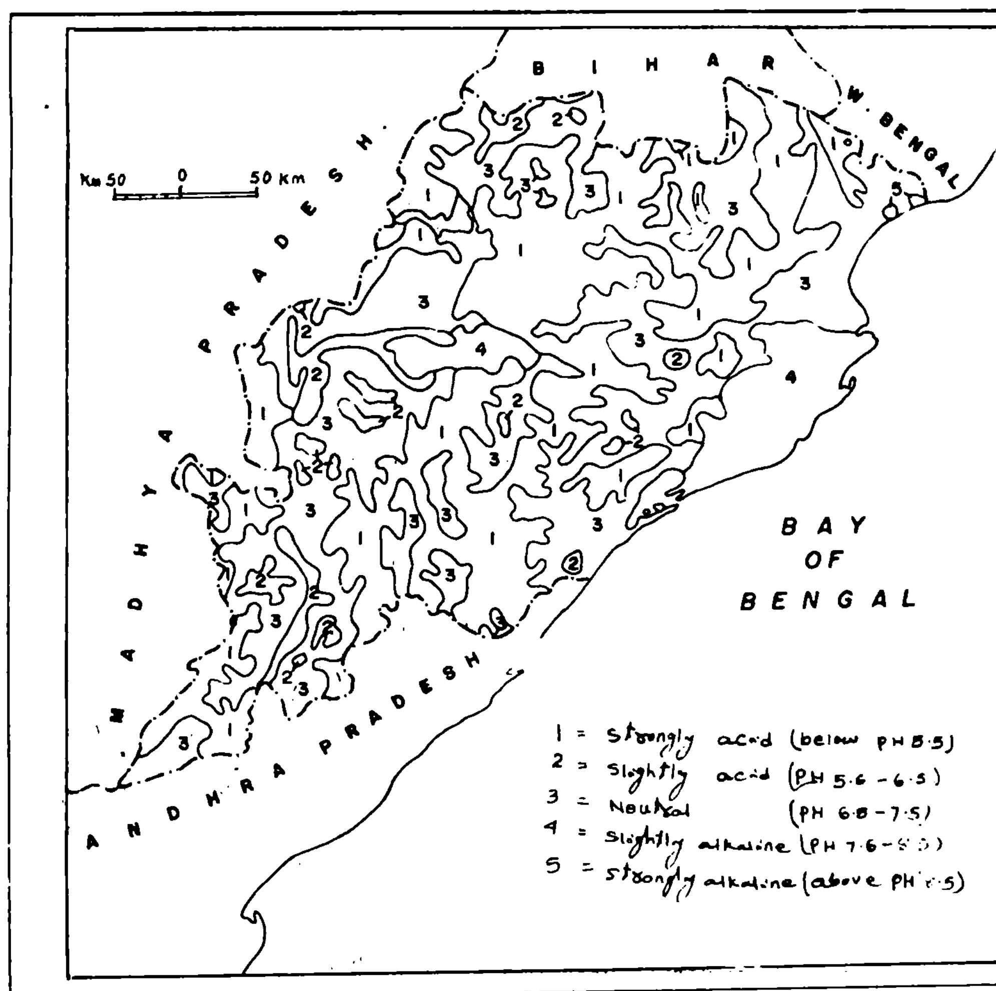
SOIL TYPES OF ORISSA



Source : Agricultural Atlas of India.

Table - 5 : Soil Occurrence & Soil Characteristics of Orissa

Type of soil	Districts of Occurrence Northern plateau	Central Table Land	Eastern Ghat Region	Coastal Tracts	Characteristics	Main crops grown
1. Red loamy soil	Keonjhar Mayurbhanj	Dhenkanal	Kalahandi Phulbani Koraput	Greater part of Cuttack, Puri, parts of Balasore	pH is acidic to neutral, deficient in nitrogen, phosphorus & potash, requires liming under Fruits highly acid condition, pH is acidic to neutraldeficient in N-P-K	Paddy Ragi Potato
2. Red sandy soil	Sundergarh	Greater part of Bolangir part of Sambalpur	Gunpur and Rayagada tact of Koraput	Ganjam		Paddy Ragi Potato Fruits
3. Laterite soil	Sundergarh Mayurbhanj	Dhenkanal Phulbani	Koraput Ganjam, Balasore	Cuttack Lime	Deficient in N-P-K & Potato, Fruits.	Paddy, Ragi,
4. Red and yellow soil	Sundergarh Keonjhar Mayurbhanj	Bolangir Dhenkanal	Kalahandi Phulbani		Deficient in N-P-K and humus	Paddy
5. Black soil	Sundergarh Keonjhar Mayurbhanj	Sambalpur Bolangir Angul	Dharamgarh	(i)Bhandari Pokhari (ii)Kalakala area (iii)Banpur-Sunakhala (iv)Aska	pH alkaline	Paddy, Wheat Groundnut, Millets
6. Alluvial soil (a) Coastal alluvium	—	—	—	Ganjam, Puri	Light textured, interspersed with saline areas, deficient in N-P-K	Coconut Paddy
(b) Deltaic alluvium	—	—	—	Balasore, Cuttack	Medium to Heavy, more silty in texture	Paddy Coconut
(c) Old alluvium	—	Sambalpur Bolangir	—	Balasore, Cuttack Puri	Coconut	
7. Saline	—	—	—	Ganjam		Self-resistant Paddy, Fishery



ACID SOILS OF ORISSA

Soil Acidity is a major factor for low productivity. Thirty percent of the cultivated soils of India are acidic whereas in Orissa it is about 70%. It has been estimated that about 48 lakh ht of land are acidic out of which 5 lakh hectares have high acidity. Availability of nutrients like Al, Mn and Fe increase due to higher dissolution and at times become toxic. In acid soils as Ca and Mg supply is reduced, plant growth suffers.

SOIL EROSION

Meteorological data reveals that on an average the State receives an annual rainfall of 1500 mm. approximately. As such the total quantum of runoff from the State is 31.5 cms. This enormous quantum of run-off detaches 364.980 million metric tonnes of soil and brings them in suspension. During the flow, 38.62% of the soil is deposited along the natural drainage system.

Table - 6 : Districtwise Rainfall & Soil Loss

Sl. No	Name of the district	Geographical area in hect	Constant	Average Precipitation in cms	Quantum of run-off in cms	Quantum of soil loss in Mt (As per observation)	Gullies/ Ravenous Land (Area in Hect.)
01.	Balasore	6,47,000	0.17	148.1	25.177	4.840208	—
02.	Bolangir	8,83,000	0.30	131.9	39.570	12.579323	313
03.	Cuttack	10,89,000	0.15	144.1	21.615	4.736859	—
04.	Dhenkanal	10.92,000	0.20	137.8	27.560	26.972259	1,112
05.	Ganjam	12,20,000	0.40	128.1	51.240	31.442206	3,981
06.	Kalahandi	11,58,000	0.35	138.5	48.475	35.576560	9,508
07.	Keonjhar	1,31,000	0.35	142.5	49.875	28.240215	20,953
08.	Koraput	27,02,000	0.45	149.5	67.245	56.767973	28,083
09.	Mayurbhanj	10,40,000	0.40	159.5	63.800	36.030188	4,926
10.	Phulbani	11,04,000	0.40	140.3	56.120	30.876341	13,645
11.	Puri	10,46,000	0.15	139.7	20.955	16.798710	2,983
12.	Sambalpur	17,49,000	0.35	141.3	49.455	44.492985	5,997
13.	Sundargarh	9,79,000	0.35	140.3	51.765	35.626753	21,156

Source : Dr.K.L.Pujari, 1993

WASTELANDS

The idle wastelands of Orissa, are causing serious environmental hazards, as well as acute erosion. As a matter of fact these are the spots acting as the major foci of erosion in Orissa. A committee called the Upal Committee was instituted by the Govt. of India, (under the Ministry of Food and Agriculture) to study the wastelands in the later fifties (1959). At the instance of the Upal Committee, the Directorate of Soil Conservation in the Mid-sixties (1964-70) undertook a rapid reconnaissance survey of the wastelands in Orissa in continuous blocks having area more than 20 acres or so. The district-wise occurrence of wastelands estimated by them is presented in Table - 7.

Wastelands by remote sensing : The first attempt in Orissa to locate and estimate area under different categories of wastelands over seven (out of 13) districts of the State was completed by the Orissa Remote Sensing Application Centre/Survey of India. (Table - 7). The work was done at the instance of the Central Wasteland Board. These data generated, however, does not distinguish private/Govt. land ownership.

The extent and existence of wasteland is quite high as seen in Table - 7. Wastelands are increasing constantly due to improper and unscientific land use and land managament. The consequences of this is very costly and alarming. The establishment of Wasteland Management Boards at the district level is a welcome decision, but that it can attain the desired goals is very doubtful.

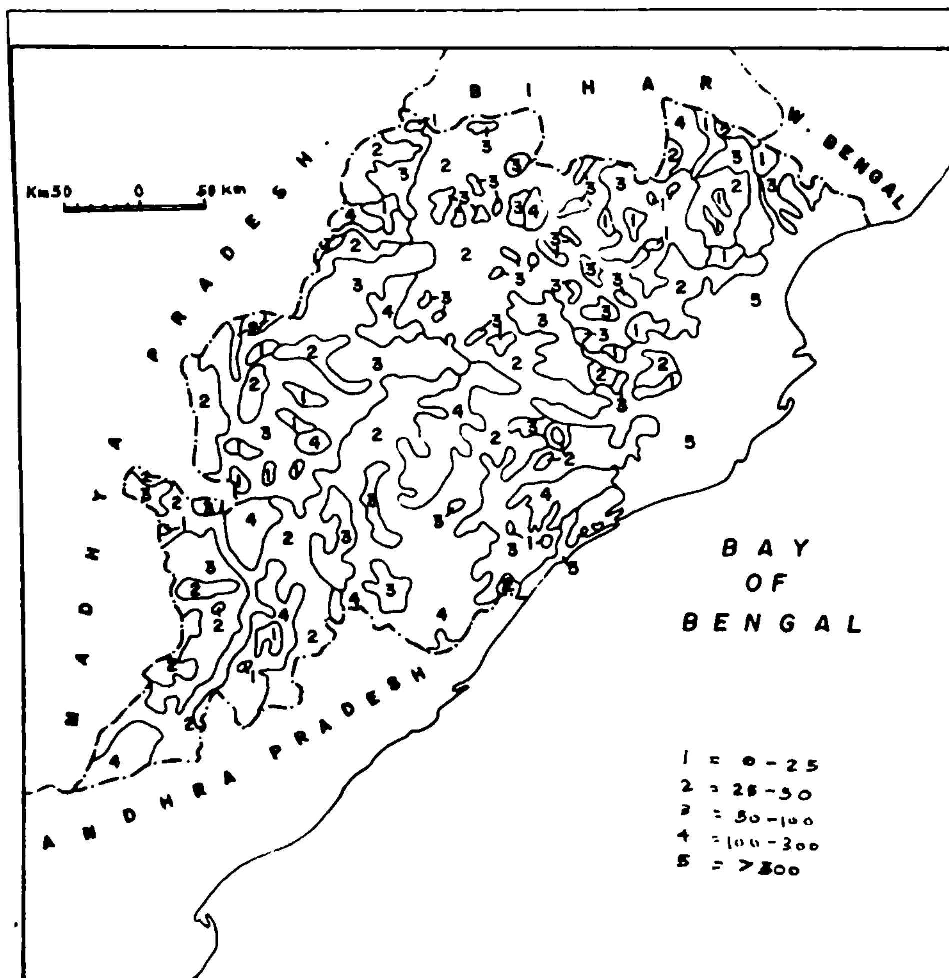


Table - 7 : Wastelands in Orissa (1964 - 70)

	Area available in category (Acres)		
District	Saline land Category-I	Eroded land Category-II	Total (Acres)
1. Cuttack	7,250	—	7,250
2. Puri	3,474	—	3,474
3. Kalahandi	—	17,310	17,310
4. Dhenkanal	—	1,250	1,250
5. Keonjhar	—	500	500
6. Boudh-Phulbani	—	622	622
7. Ganjam	—	10,346	10,346
8. Sambalpur	—	4,930	4,930
9. Sundergarh	—	11,135	11,135
10. Bolangir	—	4,451	4,451
11. Koraput	—	79,513	79,513
TOTAL	10,724	1,30,057	1,40,781

Gullies & Ravines : Even though these areas have not been properly estimated, such wasteland exists in Rayagada and Gunupur area, in undivided Koraput district along the river Vanshadhara and Nagavali; Angul subdivision of Dhenkanal district along Mahanadi/Brahmani; Anandpur sub-division of Keonjhar district along river Baitarani, and Panposh sub-division of Sundergarh district along the river Brahmani.



Pix Ghani Zaman for CPSW

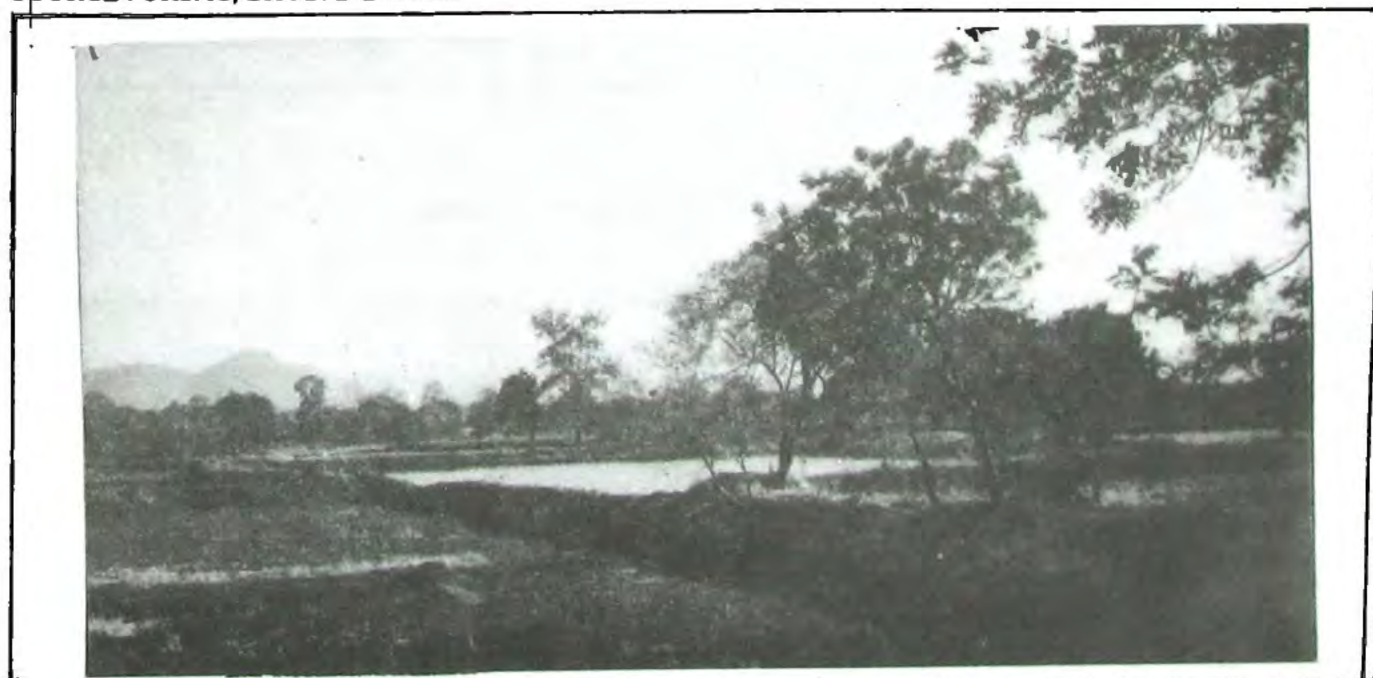
Land Erosion : Can we afford to loose our valuable resource developed over millions of years.

Table - 8 : Different Category of Wastelands in Seven Districts of Orissa

(Area in Sq.Kms)

CATEGORY OF WASTELAND	BOLANGIR	CUTTACK	DHENKANAL	GANJAM	KALAHANDI	PURI	SUNDARGARH
1. Gullied/rivinous land	6.41	6.57	21.87	60.718	4.43	29.04	21.05
2. Undulating upland with or without scrubs	263.51	102.71	152.52	105.525	802.99	169.24	267.52
3. Surface water logged land/marsh	0.17	89.44	0.50	24.110	—	175.18	3.01
4. Salt affected land	—	0.99	—	—	—	15.59	—
5. Shifting cultivated area	—	—	—	46.760	7.94	—	1.4
6. Degraded forest land	891.51	436.67	1234.15	3034.570	365.07	1029.34	766.07
7. Degraded plasters/Grazing land	1.5	0.59	0.91	0.910	3.98	0.19	5.35
8. Degraded Non-forest plantation land	5.85	1.91	0.88	26.665	3.97	89.63	10.78
9. Strip land	—	—	—	—	—	—	—
10.Sands	10.50	77.18	1.51	21.670	—	57.66	0.1

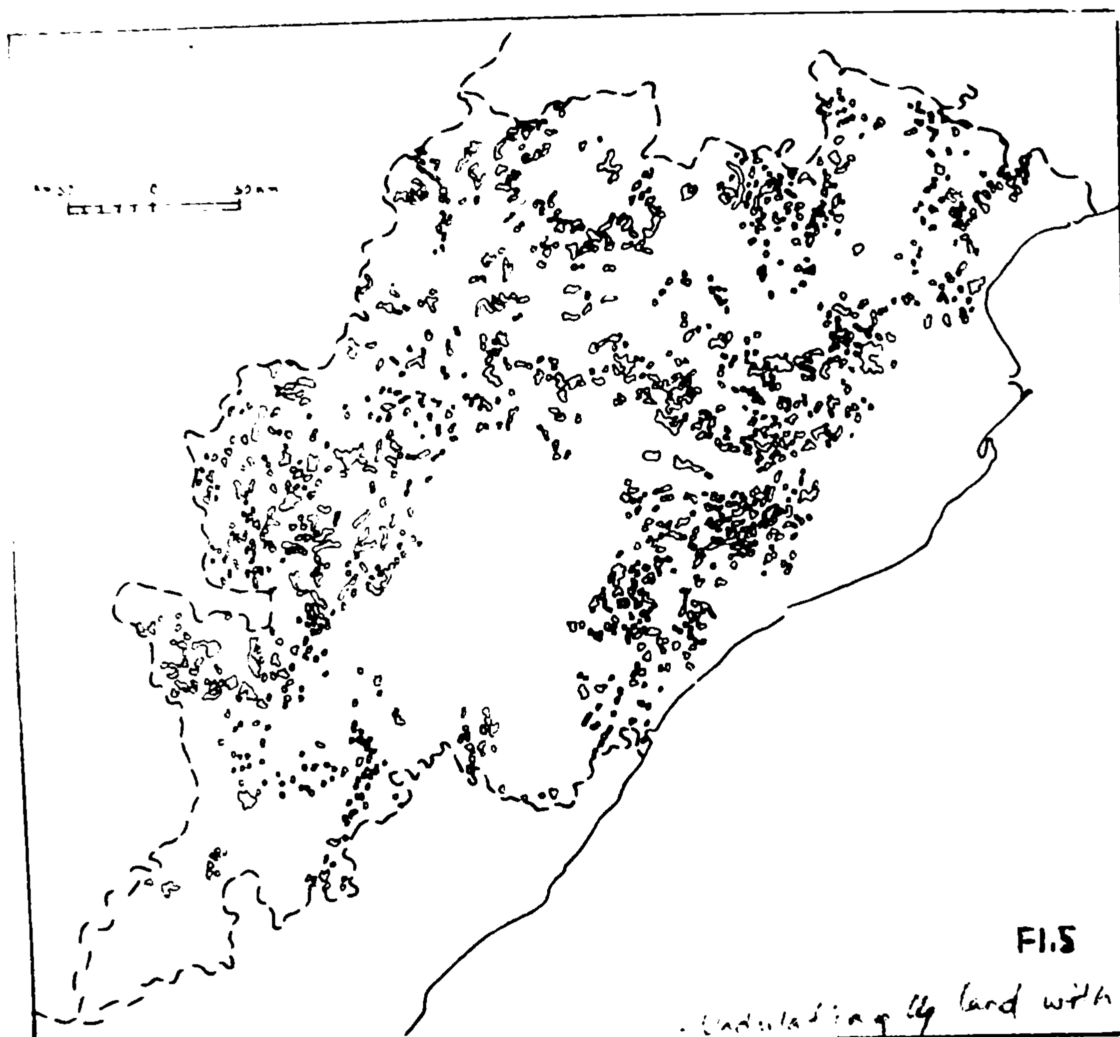
SOURCE : ORSAC, BHUBANESWAR



Pix : Manoj K Pradhan

Orissa looses million metric tonnes of soil every year.

PREDOMINANT WESTE LAND OF ORISSA



Source : N R S A, Hyderabad.

CATCHMENT EROSION & SEDIMENTATION OF RESERVOIRS

In Orissa there are several river valley projects like Hirakud, Machhkund-Sileru, Rengali-Mandira, Upper Kolab, Indravati and Subarnarekha where soil degradation is fast catching up.

Mahanadi Catchment ; It has been estimated (Pujari 1991) that 12.90 million tons (mt) of soil are washed away from Mahanadi Catchment area every year, out of which 4.98 mt (38.63%) is retained enroute and balance 7.92 mt. soil flows into the reservoir as sediment.

The catchment area (Orissa Portion) of Hirakud reservoir sheds in accordance with All India Land Use Survey Report. Based on study 44 watersheds have been categorised to four different priority classes, viz., very high, high, medium and low and on non-agricultural land from degradation and management point of view.

The reasons for increased soil erosion in this catchment are :

1.Land redemption for road construction/temporary fair weather road, industrial growth, house construction, etc.;
2.Large scale deforestation and soil degradation;
3.Unscientific land management practices in the catchment area;4.Quick siltation of gully control structures and silt retention dams.
5.Lack of maintenance of different soil conservation measures taken in the catchment.

So it is felt necessary that unless the catchment of the reservoir is fully protected, vast areas of land will inevitably be lost.

PROBLEMS OF INDRAVATI CATCHMENT

A reconnaissance natural resources survey of the Indravati catchment for the proposed reservoir of Upper Indravati Project in Orissa was carried out employing Remote Sensing techniques. Status of natural resources and terrain conditions of 1989-91 have been mapped. Suitable soil conservation strategies have been recommended on the basis of the information provided by the study to avoid the problem of soil erosion, to maintain the ecological balance as well as for sustainable development of the Indravati catchment.

A) Occurrence of Wastelands : From the landuse/land cover map of the catchment area prepared from satellite data, it is revealed that 1663.65 sq.km (1,66,365 ha.) of land of little productive use (wastelands) are present in the entire catchment area of 2639.45 sq.km (263945 ha).Uplands with or without scrub, a sub-category of wasteland in the project area, is estimated to spread over 11619.1637 sq.km (1,61,916.37 ha) i.e. 61.34 per cent of the total catchment area. This type of wasteland is found scattered and covers more than half of the catchment area. Barren rocky outcrops occupy 43.075 sq.km (4307.5 ha) of the catchment i.e. 1.63 per cent. These types of lands are prone to erosion and degradation. Gullied lands occurring along stream/rivers and in the foot hill zones are spread over an area of 1.02 sq.km which is 0.03 per cent of the catchment.

B) Unscientific Hill Slope Cultivation : Land capability assessment of each distinct physiographic unit shows that the hills i.e. structural, denudational and residual, belong to class VI i.e. suitable for forestry and pasture with minor limitations. But the existing land use pattern shows unscientific agricultural practices on the hill slopes which presently threatens the ecology of the catchment and in time will also hit the entire multipurpose project.

C) Soil Erosion : Majority of land under crop in the area has slopes which are not intercepted by any terracing and/or bunding. Mapping of erosion prone areas in the project area has been attempted after study of slope, vegetation, drainage and physiographic location of all the landscapes. An area having less vegetation, high drainage density and higher slope seems to be affected by a higher degree of soil erosion in comparison to an area having high vegetative cover, low drainage density and less slope. This problem of soil erosion in the catchment seems to play a negative role in silting and thus shortens the life span of the proposed reservoir.

Natural Resources Management in Catchment : It is proposed to demarcate hills of ten per cent slope with a diversion-cum-bund on which two staggered lines of Sisal (Agava sisalana) will be planted. The demarcating line apart from diverting surface run-off to the pediment and valley slopes down below will act as a barrier line for future landuse programmes. It should be stipulated that beyond the demarcating line shifting or any type of permanent cultivation will not be taken up.

The pediment slopes now under cultivation are very poorly bunded. Terracing is recommended for the area. Medium lands which have milder slopes can be put under field boundaries. Upgradation of the land with or without scrub by gap-filling and planting with species like mahua, cassia, sima ruba, mango, jackfruit should be done. This would yield regular income on a seasonal basis and people will find employment from collection, processing and marketing of the produce.

Pastoral plantation on pasture lands and on field bunds to provide supplemental forage to the live-stock throughout the year can be raised. Plantations of species like *Glyricidia* and *Cassia siamea* on field bunds and vacant sites to provide foliage for green leaf manuring needs to be undertaken.

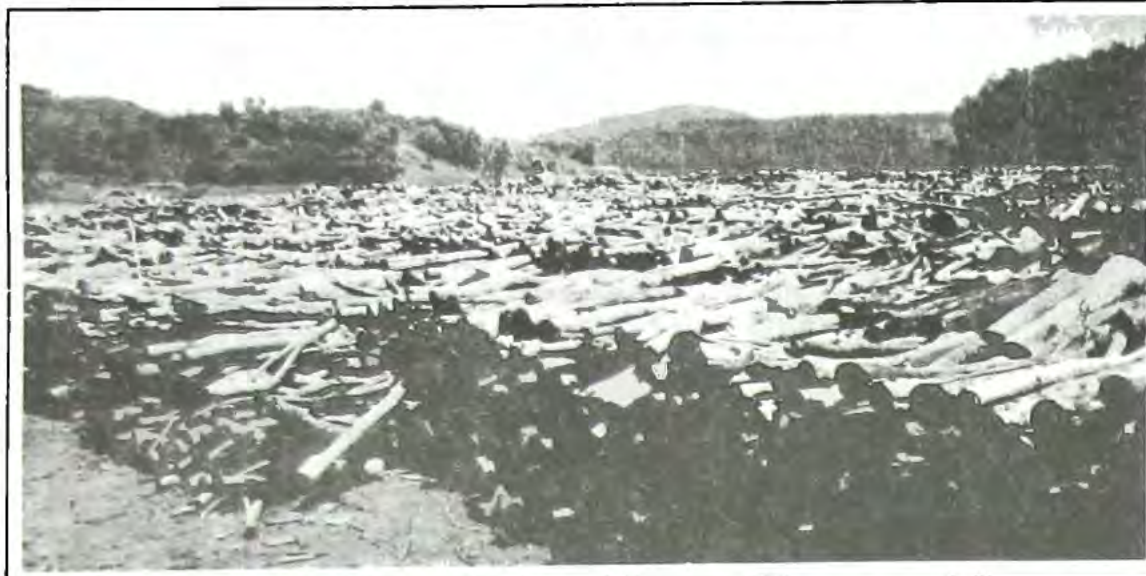
Mining : Mining operations of the Bafalimali plateau where there is a capping of 195.73 million tonnes of bauxite ore may be avoided. Bafalimali complex constitutes nearly half of the catchment area and due to mining operations in these areas soil erosion will be enhanced several times over and ultimately the proposed reservoirs of the project would face the problem of siltation. Building of an industry/plant inside the catchment should therefore be prohibited by planners.

Pix : Samuel Gade for CPSW.



Soil removal threatens the land and valuable forests - damages the top soil. Degraded catchment in Indravati

Eucalyptus plantation and logging for industrial purposes, how does it help in soil conservation ?



Pix Ghani Zaman for CPSW.

Machhkund-Sileru catchment

In the Orissa portion of the catchment area a sediment rate of 1.25 mcm per year, was observed in 1955-57 working out to 164% of the originally estimated value forms. During 1956-57 soil conservation methods were initiated because of which the silt deposit in Jalaput dam over Machhkund has come to down by 6 lakh cft by 84-85 from 275 lakh cft in 1959-60.

Rengali-Mandira catchment : In the 9,9064.4 sq.km. catchment, forming the Orissa portion it is found that between 1984 and 1989 the average sediment inflow rate is 1.35 he.mtr per 100 sq.km. per year working out to a 61.42% reduction.

Land Degradation by Mining & Mine Spoils : Assuming mine spoils to have been dumped over equal extent of the area under active mining operations leaving aside abandoned mined area, the area works out to be nearly 194 thousand hectares which is more than one per cent of the total state area. That is, for every 100 hectare of land there is environmental set back of at least 1 hectare of land due to mine spoils. To exploit Orissa's rich deposit of ores and mineral wealth, the State authorities have leased out more than 135 thousand hectares, out of which more than 96 thousand hectares are areas where active mining operations are in progress. Most of the mining areas are open cast mines, where the overhead mine spoils are dumped in the neighbouring lands causing serious ecological setback to the vegetation since some of the mine spoils have toxic elements. Besides the problem of the mine spoils, land subsidence is another problem. In underground mining, defective stowing of sand, poor surface drainage are the main cause of subsidence. In case of open cast mines defective angle of repose while excavating the mineral/ores and filling up the debris is the usual cause of land subsidence. The third problem is the reuse of the burrow pits, from which the ores and minerals have been excavated out. There is no effort to store the top soil and reuse the land after it is mined. Many of these open pits can be shaped and sized to store water for irrigation/pisciculture and allied uses.

Unused Strip Lands : Land along public roads, railways and H.T. transmission lines and canals of the kind become the foci of erosion since there are often scattered burrow pits for maintenance of the roads. There are efforts to bring these lands under plantation through Social Forestry (community forestry) in Orissa. An estimate of total strip land along the roads of different States including Orissa shows that about 1.4 lakh hectares of such strip land lies in West Bengal, 0.80 lakh in Bihar and about 1.2 lakh hectare in Orissa. Besides vast stretches of land are lying idle along railway tracks.



Pix : Sanjay K. Khatua.

Strip lands - Lakhs of kms. in Orissa can follow such ancient ideas.

COSTAL LAND PROBLEMS

Water Logging : The water logging situation is serious during July- August. Due to drainage of water from the upper end to the coastal plains and slow disposal of accumulated water in the plains to the ocean, the waterlogging problem becomes serious. In some low-lying lands, water stands above the surface throughout the year.

Water is receding in some areas after 5 months - a scene from Brahmagiri area in November, 1990. Pix : Manoj K. Pradhan.
(- Slope land cultivation is becoming unsustainable today.



Water logging and drainage problems have reached an alarming dimension in the delatic region of Mahanadi river. The century old delta stage-1 (Cuttack District) and the recently started delta - 2 (Puri District started in 1972) are badly affected by water logging due to drainage congestion. The yields of Rice, Greengram, Blackgram, Horsegram, Sesamum, vegetables and Jute has reduced by 65,84,83,100 tons. Out of 3,03,000 ha CCA, 13,200 ha as become unsuitable for cultivation throughout the year, 42,100 ha has unsuitable for cultivation in Kharif, 55,300 ha in both the seasons. But due to bad drainage 3,600 ha cannot be economically retrieved. Such lands constitute 34,91% of the 1,67,000 ha CCA of Cuttack delta and 41.10% of the 1,36,000 ha CCA of the Puri delta.

In Hirakud Ayacut the absence of adequate outlets increase the waterlogging problems. Rice cultivation in all types of land and over irrigation are the main causes of waterlogging in these areas. Due to waterlogging about 20% of Bhal land has been rendered useless and is now out of economic cultivation. Between 1958 and 1978 the water table went up by 3 mts.

Effects of Waterlogging on soil & crop productivity : Waterlogging reduces soil erosion. Its immediate effect is reduction in oxygen concentration and build up of CO_2 and other gases. Increased moisture content reduces soil temperature due to increased thermal conductivity and decreased diffusivity but beyond a critical value diffusivity is less affected. A well drained soil becomes warm faster than a wet soil due to high specific heat of the latter. Increased moisture content also increases soil albedo. Soil temperature affects germination, growth and development of crops. Due to low temperature, roots do not grow faster. Their ability to absorb nutrients decreases, in turn carbon synthesis and transpiration also decreases. The roots don't branch. Maize and pulse crops die if water stagnates for more than 3-4 hours.

Adverse effect of waterlogging on soil structure is due to reduced microbial activities on account or reduction in O_2 concentration and death of microbes. Soil tilling at high moisture content increases shearing stress, puddling and decreases soil structure. If drainage is free, leaching of calcium, magnesium and nitrates makes the soil infertile. If drainage is impeded, these salts accumulate at the lower layers and in due course of time their migration to and accumulation at surface increases salinity hazards. Increased concentration of sodium disperses soil, results in single grained structure and increases drainage problem. Drainage improves soil structure and restores soil fertility.

Flooding of waterlogged areas results in fully or partially anaerobic conditions, in which the oxygen contents remain absent, because the soil microorganisms use up the soil oxygen faster than the atmospheric oxygen can diffuse in. Shortage of oxygen results in many reductive reactions and affects crop growth. Excess water in soil restricts microbial activity partly or fully because it prevents movement of oxygen into and through the soil in sufficient quantity to meet the oxygen demands of soil organisms. Waterlogging decreases the population of aerobes in favour of anaerobes; it causes root rot in several crops, fusarium in pineapple and helminthosporium and blight in wheat.



Pix : Manoj K. Pradhan.

Ring bundhs in Kanas and Brahmagiri has caused several conflicts, killings and continuous social tension and political unrest.

DRAINAGE PROBLEM

Drainage problems can be identified by regular field observations. (i) Accumulation of water in depressions for long periods in the year, (ii) barren patches due to accumulation of salt, (iii) high concentration of salts in surface layers and white crustation here and there and (iv) a shallow water table are a few indications of drainage problems. Stunted crop growth, shallow root depth, yellowing of leaves, increased infestation of diseases and pests and delayed maturity, are symptoms of waterlogging. Lands blocked by roads, railways and embankments; those adjacent to unlined canals and reservoirs; and bad quality irrigation which induces imperviousness in the soil, all lead to waterlogging. Investigations determine the cause of waterlogging and suggest methods of treatment to overcome it.

Weeding and Chocking of river water passage Brahmagiri, also blocking for fishing aggravates the problem



Pix : Manoj K. Pradhan.

Encroachments : Drainage channels, both natural and excavated, function mainly 3 to 4 months in the case of south-west monsoon and a couple of months in addition during the north-east monsoon in the case of States like Tamilnadu, Andhra and parts of Orissa. Since for the rest of the months, there is no flow in these drainages, there is a tendency towards encroachment into the same. The encroachment is sometimes by private people for cultivation of the drain banks, berms and even beds.

Quite often, some states lease the rights of construction of temporary bunds for irrigation and/or fishing across these drainages in the interest of food production as well as revenue. There are cases of construction due to inadequate waterways and insufficient number of crossings which have led to construction of unauthorised crossings. These practices lead to deterioration of drainage channels. A large number of depressions, locally known as 'Talas', 'Beels', 'Chaurs', etc. have also been reclaimed for cultivation. Flood waters which used to find their way to these depressions and were being detained for long, now get drained off quickly. This has further aggravated the peak floods in drains and rivers. Since encroachments into drains (natural or excavated), do not have the sanction of law in any of the States in the country and since there is a general agreement that such encroachments have aggravated flood problems, suitable enactments should be made in the States, (where not existing at present), to deal with this human and socio-economic problem.

River bed Cultivation : Cultivation of river beds and berms is permitted in Orissa, by a short-term lease, granted by a Revenue Officer, unless objected to by the flood control authorities.



Natural nalas has been encroached in many areas and also they silted up due to cultivation of uplands areas



Pix : Manoj K. Pradhan.

SALINITY IS AN INCREASING PROBLEM

In coastal areas where paddy is cultivated salt influence reduces the productivity considerably. The eleven blocks identified in the coastal areas total 2,54,101 hectares of different categories which is increasing year after year.

Marine landscapes : The flotation process by which the littoral or long shore current along the Bay of Bengal that carries heavy sands over the years creating an "offshore bar" or a shield deposit of salt and clay. This process goes on till the intervening sea is cut-off due to heavy deposits and the adjoining coast joins the main landscape. But the deposition of clay due to heavy saturation of Na^+ and water remains like a 'slurry mass' (high N value). In summer, there is irreversible dehydration followed by leaching in rains. Due to dehydration there is subsidence in topography & ultimately depression or creation of low lands. Sometimes these depressed landscape also get a flush of tidal board and the saturation of sodium makes it more and more saline. It is also interesting to see that, saline loving aggressive plants like Bani *(Avicinia alba)* having peculiar viviparous root system, followed by LUNA GIRIA (a saline resistant weed) and some other saline resistance woody species appear till the soil becomes fit for agriculture and traced paddy cultivation is possible.

Estuarine landscapes : ESTUARINE landscapes are lands along the estuaries of the rivers like Mahanadi, Brahmani and Baitarani. The mechanism of deposition is slightly different from that of marine origin. In the estuaries the silt laden river water gets mixed up with saline water of the sea, before or even after the deposition in the bank of the rivers or its branches along the creeks. The levee deposits of the lower flood plain of Mahanadi, delta and the crevasse deposits oriented along the direction of flow of the river and creeks are the examples of such landscapes.

Lacustrine Deposits : Lacustrine deposits are sediments deposited along the periphery of the lake Chilika. The sediments which are carried by the rivers every monsoon, gets mixed up with the brackish water and as such are saline. Moreover the Chilika swells up during peak floods submerging adjoining land where failure of crop due to salinity occurs frequently. It is estimated that there are about 450 sq.miles of cultivable waste around Chilika which is affected by salinity.

Table - 9 : DIFFERENT CATEGORIES OF SALINE LANDS

(Area in Hectare)

Category of Land	Marine	Estuarine	Lacustrine	Total
Agriculture	90,494	79,654	23,263	1,93,411
Mangrove	13,344	7,572	3,250	24,166
Idle Land	21,466	1,056	14,002	36,524
Total	1,25,304	88,282	40,515	2,54,101

Reclamation Measures for Saline Areas : Reclamation of the salt-affected soils can be carried out according to the local conditions by preventing tidal water inundation through construction of bunds, leaching of salts from the soil profile and through application of suitable amendments in the case of the acid sulphate soils and sodic soils, and adoption of other suitable soil-water and crop management practices.

Inland Saline Soils : Salinity of inland soils occur in sporadic patches in the valleys and foot-hill regions, where there is generally spring seepage. The cause of salinity here is mainly due to the fact that Salt is carried by underground seepage water, which is being evaporated off at the foot-hill or valleys leaving the salt behind. These are the 'SALT LICKS' inside or outside forest areas to which wild animals are attracted for meeting their salt need in the patches, where salt concentration has increased, as a continuous process of spring seepage. The effective control for putting such land to production is to have a deep cut-off trench along the hill sides to divert and cut-off the underground seepage. Besides the above, sodium rich primary minerals in the parent rocks, out of which soils are formed, are sometimes responsible for soil salinity. Occurrence of the country rocks having such minerals have been the likely cause of salinity in Inland districts like Bolangir, Kalahandi and Keonjhar areas, which warrant study.

Leaching of Soluble Salts : The leachability of soils may be improved in different ways like (1) appropriate soil management, (2) lowering of the water table, (3) improvement of drainage conditions and (4) adoption of suitable water management practices. In a lysimetric study conducted at Canning with a silty clay loam soil, Sen, and Bandyopadhya (1976) found that mixing sand with the surface 15cm soil at the rate of 30% by volume helped in improving the water flow condition of the soil. They also reported that surface soil mulching with rice husk (10t/ha) helped in improving the soil physical condition, which in turn, resulted in a greater intake rate of water into the soil under continuous submergence and consequently, in a larger displacement of salts even from greater depths of the soil profile. It has been further observed that mixing rice husk, saw dust, with surface soil by ploughing during the fallow winter period after the harvest of kharif rice significantly increased the rice yield during following monsoon season and leached out salts from the soil profile. This practice can be utilised as an alternative where it is not possible to grow winter rice crop due to lack of good quality irrigation water.

In Orissa, people use organic residues to correct the salinity hazards in the soil. In the loamy soils of Tamil Nadu, application of organic matter and gypsum were found to be beneficial, whereas in the sandy soils the green manure alone at the rate of 5000 kg/ha was found to improve the soils. In the Khar land of Maharastra the soils were ploughed deep & rice was grown. The application of organic & green matter is also recommended in those areas.

SANDDUNNING : A MENACE

Sand dunes, a result of strong prevailing winds, are extensive in the Orissa coast. More than 55,000 hectares of sand dunes are found there. These dunned lands have the poorest soil from an agricultural production point of view. The soils are not only infertile, but also a menace to neighboring agricultural lands due to their shifting nature. Extensive tracts of agriculture lands are sand cast every year in the coastal region of Orissa due to erolian action. Natural vegetation on these aeolian soils are very sparse and poor as well.

It is evident from the studies that out of 56,299.40 hectares of sand dunes 17,541.75 ht are still bare, that is, about 31 per cent of sand dunes are still active and require immediate planting, whereas about 56 per cent have scarce vegetation, which requires gap filling reforestation by the Government to save adjoining agricultural land and village sites from ravages of cyclone and shifting sands.

IN APPROPRIATE & INADEQUATE SOIL CONSERVATION PROGRAMME

As per the Government of Orissa report, more than 5 lakh hectares of land have been brought under effective soil conservation measures till 1990-91.

SOIL CONSERVATION IN MAHANADI CATCHMENT : A CASE STUDY

Soil conservation measures were initiated in the catchment during 1956-57. During the 2nd Plan Period, the measures were limited to bunding, plantations and gully control works. During the 3rd Plan Period, emphasis was given on pasture development, stream bank erosion control and water harvesting structures. The package of treatment included bunding, terracing, plantation of cashew, sisal and miscellaneous species, pasture development and construction of engineering structures like water harvesting structures, gully control, farm ponds and silt retention dams at suitable sites.

Out of total 11,690 sq.mts of Hirakud catchment area, soil conservation measures were taken up on 1,314.79 sq.km., working out to only 11.24% of the total catchment area.

Soil conservation measures taken.



Pix : Ghani Zaman for CPSW

SOIL & MOISTURE CONSERVATION

A CASE STUDY FROM KALAHANDI

Construction of water harvesting structures in Kalahandi District instead of providing irrigation to farmers, affects the natural irrigation and agricultural productivity severely, according to a study conducted by 'Lokdrusti' a Khariar based Voluntary Organisation in Kalahandi district. The study was conducted as per the suggestion given by the district collector to confirm another study made by the Natural Calamity Committee meeting held on 26.6.89. Construction of Water Harvesting Structures (WHS) was undertaken on a large scale under DPAP and ADAPT schemes for providing irrigation to the drought affected areas. The Soil Conservation Organisation of Kalahandi district was assigned to undertake ADAPT scheme to construct 588 WHS in 2-years at a cost of Rs.857 lakhs. It was estimated that each WHS will irrigate about 15 acres of land and about 6,000 hectares would be provided in Kharif irrigation, when all these structures were completed. Contrary to the statements and reports of ADAPT and the SCO, the experience of the people was very negative about these structures. Hence, this study was undertaken to find out the truth. Lokdrusti studied 10 WHS on a sample basis from three most drought affected blocks of Kalahandi district namely Khariar, Boden and Sinapalli.

Deprivation of Natural flow Irrigation : There are many cases in Kalahandi district and elsewhere, where water harvesting structures are depriving the farmers of the natural flow of water, rather than providing irrigation. One such case is that of Sangadi - Nuapada village of Khariar block where a WHS, constructed some 8-years back by the Soil Conservation Organisation, hardly accumulated 3 to 4 feet of water. Before its construction, there were two perennial streams providing sufficient irrigation for 37 acres of land belonging to small and marginal farmers. People believe that these sources are buried underground due to siltation caused by this structure. The study also revealed another interesting act of the Forest Department which had constructed a trench just below the W.H.S. This trench drained out whatever little water was passing through the seepage, effectively depriving the low-lands from irrigation. Normally, the land is at a higher level than that of WHS and the water level does not reach the sluice level. Hence, there is absolutely no water flow for irrigation. At times of scarcity, in 1989, the villagers of Sangadi-Nuapada collected water in Drums and carried them by bullock carts for irrigation. A similar case was found in village Dab of Boden block where the single natural flow was obstructed by the WHS constructed by the Soil Conservation Officers in spite of people's resistance.

Anti-People Measures : Farmers for whom such structures are constructed, are never consulted in the process. Considering them to be "unnecessary problems" officers feel competent and capable enough to achieve results. But what happens at the end ? The villagers of Dhobie, Boden Block demanded the construction of a structure across "Bhim Jhola" a nearby stream. The soil conservation officials did not heed to this request. So they appealed to the District Collector and also to Sri Madhav Singh Solanki, Union Minister who visited the village. When this did not work the people did not cooperate with the work of the SCO, who selected a site unsuitable to the people. Instead, they themselves constructed a diversion weir across Bhimjhola and dug a canal. The Landless and poor were forced to work in the W.H.S. of the SCO because of their helplessness. Another W.H.S was constructed over an existing board used as a drinking water source

THROUGH W.H.S.PROMOTION

Soil is conserved, but the farmers below the W.H.S. are affected.



Pix : Ghani Zaman for CPSW.

for the cattle near the village Gameraguda of Sinapalli Block. In this structure, as the water level was 4-5 feet below the surplus weir and 6ft below the sluice, it submerged 29 acres of crop lands and after reaching the sluice level it flooded the house of Sri Dandsena who had to shift his household articles to a higher place. He complained to the Prime Minister but this was of no avail. Then, he went on a 14 days long fast in front of the SCO at Khariar, starting from 1st March, 1989. After a high level inquiry, the surplus was constructed and reconstructed thrice. As on 05.08.1989, the water level was still much below the surplus and some cultivable land remained under water. Reconstruction of the surplus was going on for the fourth time when this study was completed.

Poor quality work & poor maintenance : The WHS of the village Sunapur in Boden block has been washed away four times since its construction in 1985-86 (i.e. two times once in 86-87 and 88-89). The crop land of a poor farmer who has a 16-member family has been sandcasted four times. He never received any compensation for this.

Problems Identified :

1.The policy of the Government and political pressure forced the S.C.O to fulfill the norm of "One structure in one Gram Panchayat" which did not enable it to select suitable sites. Target fulfillment approach was the basic reason for failure.

2.Employment Generation was the main motive, rather than soil or water conservation. Technical considerations were not given serious thought.

3.Delayed releasing of funds and hasty implementation of programmes for achievement of financial targets compromised the quality of performance and objectives of the programme.

Decline in agricultural production : The data analysis of 32 farmers shows that 172.08 acres of their land below the structures harvested 694 quintals of paddy before the construction. It was reduced to 328 quintals of output after that. Out of this, 37-acres were not cultivated because of the stopage of natural flow irrigation. The decline in paddy out put is estimated to be 40.34% where as it is 71.18% in case of other crops. Natural flow carried silt making the lands more fertile every year before the construction of structures. Also, the landless reported decline in agricultural employment which accelerated migration from these villages.

Conclusion : Many villagers suggest that the structures should be demolished/cut and natural flows/streams (digging of soil where streams are buried) be allowed to flow on their lands as before. Water Harvesting Schemes neither conserve soil nor water. Rather, construction of diversion weirs were better and should be preferred. Mini/Micro watershed development should be promoted in the drought prone areas, with maximisation of people's participation. The study recommended complete stoppage of WHS construction as well as improvement, proper maintenance and catchment treatment of the existing ones. An holistic and integrated approach is essential for such drought affected and distress areas. Direct involvement of local voluntary organisations, people's organisations, Yubak Sanghas in the process of planning and implementation should be ensured to derive greater benefits for the people. It is now learnt that the Govt. of Orissa has taken a decision to encourage people's committees for management of such M.I.P.s with support from the Revenue Department. Hence, VOs should take this opportunity to form people's organisations.



Pix : Ghani Zaman for CPSW.

Sometimes, the designs are faulty and lack of adequate funds makes the results disappointing.

LAND MANAGEMENT - NEEDS AN INTEGRATED APPROACH

STRATEGY FOR 8TH PLAN

In Orissa 75% of the agricultural land depends on an annual and erratic rainfall, 60% of which is lost by way of run off. Soil erosion and in-efficient use of surface water are the constraints. Strategically the Government attempts to conserve moisture, protect soil from erosion and maintain fertility status, for optimum production of bio-mass on sustained basis as per land capability. For this, a comprehensive watershed development approach is being followed now. Therefore, the attempt is to treat the above 3 sectors on watershed basis. Both, marginal land belonging to cultivators & community will be treated under suitable agro-solvi-horti-pastoral crops.

DISLOCATION OF HILL CULTIVATORS

The proposed forest law which is forthcoming recommends a complete stop to shifting cultivation. This would automatically displace 10 lakh families in Orissa . The effect of such displacement would be totally miserable for the tribals who have practised shifting cultivation for centuries. Moreover there is no guarantee that they will be properly rehabilitated. Government records of rehabilitation are poor, given the fact that only 1/4th of the displaced by various projects have been rehabilitated till today. The proposal to render homeless and helpless lakhs of tribals in Orissa without implementing land reforms is something that is unthinkable. This anti people measure can be easily avoided and sustainable alternatives be provided.

Massive dislocation could have been prevented if proposed land reforms had been implemented, making the distribution of agricultural land somewhat more equitable, both in terms of quality and quantity. Very often large farmers find it more profitable, for various reasons, to grow only one crop a year and to use the remaining time and capital in other types of commercial activities. As such, better irrigation facilities, concentration of the Government's resources on highly productive land and the reversion of relatively unsuitable land to non-agricultural uses might very well decrease the overall agricultural production, and also the potential of the agricultural sector to absorb millions of displaced farmers.



Pix : Ghani Zaman for CPSW.

Stone packing to check gully formation.

Since soil erosion is most damaging, stone and soil bunds are constructed on slopping agricultural land to form bench terraces. Check dams are constructed to allow the surplus rain water to permeate. Terraces improve the water retention capacity of the soil. Even, springs dried up earlier, gradually recoup. This helps to increase the crop yields.

Long term drought proofing investments are not spent for the most prioritised works like terracing.. On the other hand, Government regards cultivators as encroachers doing illegal work and therefore fines them. They are also harassed by the police and forest officials. Unless legal settlements are made, adequate funds and technical know-how is extended, money and effort as well as a vast hill land will only go waste. However, the Revenue Department's recent order that patta can be issued upto 30° slope in Kashipur block of old Koraput district where an IFAD (International Fund for Agriculture Development) project is under implementation is a welcome step and should be extended to all areas.



Pix : Ghani Zaman for CPSW.

"Bena" plantation in stream banks is undertaken in many areas now - how useful is it for people ?

LAND DEVELOPMENT/LEVELLING

Land levelling is an important soil-moisture conservation programme in drought areas where lands are sloppy, uneven and unbunded in nature. A few field observations of this programme undertaken by Govt. & VOs are mentioned below :

Leveling of hill lands is too much expensive, but is essential. A patch of land developed by tribals in Rayagada district.



Pix : Manoj K. Pradhan.

1.This helped to some extent in soil and water conservation, adoption of improved method of farming practice, vegetable and pulses cultivation on farm bunds (Huda) etc.

2.The crop pattern on levelled lands changed. Dominantly, millet cultivation was replaced by medium and long duration paddy. On levelled lands, paddy yield went up per acre depending on soil, type of seeds and other inputs. But paddy cultivation and introduction of HYV seeds suffered most from drought.

3.It increased the land value and helped to procure bigger amount of loans and at the end benefited the farmers negatively. It promoted land alienation. Hence, the credit needs of people must be looked into first and essential support for cultivation needs to be provided.

4.It increased immediate Employment Generation for the poor and labouring class and reduced migration in the same year and also reduced the duration of migration of individual farmers whose lands were developed.

5.Women's participation in LLP and field bund cultivation increased subsequently.

This process of land development involves two issues, that of change in cropping pattern and land alienation. The tendency of the people to change over to paddy after levelling of land is a characteristic feature. This change in cropping pattern may yield high benefits but may often lead to complete failure of crops. Moreover, as land value increases after development, it promotes alienation. There is thus need for a debate on this method. In any case appropriate land development techniques, soil enrichment and moisture retention are necessary to counter the impact of drought.



Pix : Manoj K. Pradhan

Land leveling and bunding to conserve soil and water is a age old practice of people in Kalahandi. A scene of cultivated lands near Dharmagarh.

MULTIPLE-LAND USE

"Podu" land amounting 1840 sq.kms needs treatment so that it can conserve soil, moisture, ruined forest cover & benefit the tribals who depend on it. Hence, the need for multiple land use is being tried on an experimental basis in few places drawing from the experience of countries like Phillipines.

PURI WORKSHOP : A Workshop organised by CENDRET & SIDA on 15th April, 1991 at Puri in which a number of Government officials took part, clearly pointed out that SALT (Sloping Agriculture Land Technology) was an alternative to shifting cultivation. They were of the view that this technology could be tried out in different centres in Orissa, adapted to local circumstances and then spread amongst the people, with the help of NGOs and other agencies. It will therefore be necessary to start pilot projects in SALT.

Accordingly it was proposed that the four Regional Centres which OUAT managed in different parts of the State, could serve as stations for experiments and training in SALT methods. Land for this purpose would be made available by the Forest Department. Besides technical inputs from OUAT, the training wing of the Social Forestry Project, would play a prominent role in the training. Help from NGOs should be sought especially to undertake the Socio-economic and motivational escorting of the shifting cultivators, who were willing too adopt SALT as an alternative. To promote mutual understanding, personnel from the Forest Department, other Government Departments involved in soil conservation and NGOs could be trained together in the application of Salt methods.

BHUBANESWAR WORKSHOP : Representatives of NGOs took part in another workshop organised by CENDRET & SIDA on 16th - 17th April, 1991 and recommended that experiments in SALT and other alternatives to Podu must first be undertaken in all the experimentation-cum-demonstration plots and that information as well as the outcome of these experiments should be shared amongst the centres, NGOs, Forest Deptt. and OUAT.

The workshop also laid down the following : (1) Initially Demonstration plots have to be protected against roaming cattle. (2) The spread of SALT has to be attempted in one area of concentration, so that an impact area can be developed. (3) Once a sufficient number of farmers have adopted SALT, they themselves will convince others to control their animals.

The land issue was also uppermost in the minds of the NGOs. Interesting questions like will forest land on which tribals apply SALT and thus restore it to sustainability, be registered in their name ? and Will there be a patta of some kind ? Will they be assured of the usurfrut ? ; came up for discussion.

It was also suggested that as part of a programme of alternatives to Podu, including SALT, vocational training for non-farm income, was essential, that a SALT programme will need a food security programme to support it, so that people can make the transition under reasonable risk.

As described by Mr.S.C. Mishra, IFS, the FFRP component of Social Forestry project has two components : Agro-Forestry & Density Plantations. Cultivable wastelands is brought to economic use and each landless poor is allotted 0.5 ha. of land. After three years of project inputs the farmer is given usufructory rights for all the produce. The project has thus far covered 10,000 ha. in phase-I and 3747 ha. in phase-II, with survival rate of more than 70%.

Mr. Mishra further explains that "in Paralakhemundi division where shifting cultivation is practiced, he preferred an integrated pattern of horticulture, agriculture and forestry operations in rehabilitating the podu cultivators. Here the rotation of crops varied from 2 to 8 years and the crops were maintained for 3 years. Within the project period the income started flowing. Due to heavy inputs, the outputs were good and hence, the beneficiaries were attracted. The project had distributed 104 million seedlings in phase-I and 538.87 millions seedlings in phase-II. Private individuals also utilised these seedlings for raising their own trees on their terraced land, in field boundaries, backyards and marginal lands, the survival rate of these plants being around 60%. The success of this Social Forestry Project is quite encouraging.

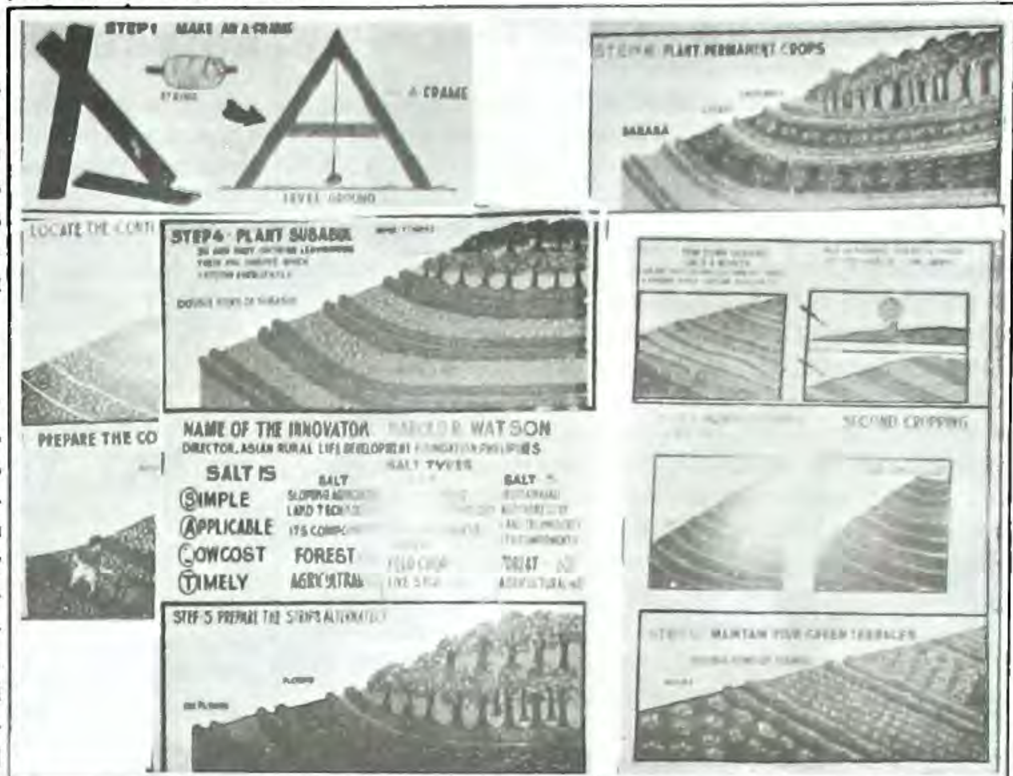


Pix : Manoj K. Pradhan

This land scape provides very little low lands for tribals. Again, low land are alienated. So, hill cultivation becomes unavoidable.

Mr.M.F.Ahmed, IFS ex-PCCF, Govt. of Orissa opines that the cash component of a project is what lures the tribals to a project. Since they are most often heavily indebted to money lenders, a project which gives them quick returns attracts them. To support this he cites the example of the successful agro-forestry project in undivided Koraput district.

SALT in Philippines can be most suitable to our hill areas - lacks political will and adequate funds.



Pix : Ghani Zaman for CPSW.

Horticultural development, found suitable in different areas includes the plantation of fruit trees such as citrus fruits, mango, banana, papaya, pine-apple, orange and coconut in limited areas. The new "Gajapati district" has been declared as a "Horticulture" district, by the Govt. of Orissa. Massive horticultural plantations have also been undertaken in the Nowarangapur district now. Jackfruit trees thrive well in Phulbani and Koraput districts. Growing of Citrus fruits are generally recommended in many areas of Orissa. Similarly hill oranges have been successfully tried in Ganjam agency and Niyamgiri areas of Koraput. In Kashipur block, tribal farmers usually grow mango, guava, papaya, pineapple and banana. Tribals in this block depend on tamarind, turmeric and grow them as their traditional business. Some tribal households have taken to growing mango, jackfruit, lichi, sapeta, banana, datepalm, karanj in their backyard and elsewhere on the land they possess. Hill slope plantation of pine apples in Rayagada - Kashipur belt has been a success. In Gudari and Niyamgiri areas of Bissam Cuttack and Pottangi, local tribals are growing hill oranges.

Along with the horticultural attempt, it may also be necessary to encourage appropriate planting of grass and fodder trees, otherwise the tribals who have been dependent on forested area for animal grazing may find it hard to rear animals.

Bamboo Forests : Bamboo forests have depleted in the State. They are the principle raw material for the paper industry but more importantly, the basket makers and artisans in the village do not get them anymore. For them it has become the crisis of their life. Bamboos are not even available for constructing houses in the villages. Earlier bamboos could be got for the asking from a neighbour or in the village at a very nominal price but now they are a rarity. Hence plantation of bamboos is a neccessity.

Medicinal Herbs and Plants : The native knowledge of the tribals on medicinal herbs and plants allowed them to use these for the treatment of many ailments. Yet now this knowledge is dying out after the advent of modern medicine. That apart, some species of medicinal herbs are dying out too. The only solution is therefore to encourage the tribals to grow such medicinal herbs and use it so that not only they preserve the heritage of indigenous medicinal knowledge and skill but also earn supplementary income through the practice of it.



Pix : Ghani Zaman for CPSW.

Indigenous distillation process developed by tribals. Their knowledge is really most valuable.

NGO APPROACH & ATTEMPTS

Several attempts have been initiated by Voluntary Organisations to promote development of tribal people and upland cultivation. Council of Professional Social Workers (CPSW), works in 20-villages of a few Gram Panchayats at Daringbadi block of Phulbani district, which is inhabited by the Khond tribe. The programme has ecological, economic & social components and its goal is to educate & demonstrate a viable and sustainable agriculture by using local resources and technologies and by Crop Rotation (instead of land rotation) Organic Framing and Soil & Moisture conservation. The first task was to build a relationship of trust with the people. To this end village committees were formed. CPSW also started Adult Education classes and used this as a vehicle to build awareness and critical thinking on shifting cultivation. A detailed plan of action is in the process of development with the full involvement of the people and village committees. The plan includes among other things : marketing, small savings, income generation for women, horticulture and fodder grasses, animal rearing, improving the variety of seeds, village nurseries, soil and moisture conservation measures.

After years of experience, the Gnumusur Mahila Sangathan (GMS) is of view that, no permanent solution to shifting cultivation is possible unless the land question is settled once and for all.

Tagore Society for Rural Development, (TSRD) is working in Phulbani district on sloppy land, and have done contour bunding. The soil is extremely poor. Through 100 non-formal education centres they have created awareness on intercropping models to save the land for agriculture and have combined it with animal husbandry.

World Vision of India, works with the Saura Community at Khajuripada, Ganjam district in a cluster of 22 target villages. These villages fortunately have a lot of tamarind trees which are owned by the community as a whole. Prior to the initiation of the project the produce from the trees were sold every year to the Mahajans at a very low rate. The money thus obtained was being used for Shifting Cultivation and emergency expenditures. The Mahajans usually sold the tamarind at a high price.

The project budgeted Rs.15,000 as tamarind loan which was given to the people for their accidental and emergency expenses. This enabled the Sauras to harvest the tamarind themselves and sell it in the market. The money they got was almost ten times more than that given to them by the Mahajans. Now they are more interested in the tamarind business, which has proved to be a good alternative to shifting cultivation.

NIPIDT, Phulbani observes that land is a very big problem. Through the process of money-lending, the people are still losing land. The NIPIDT has developed village level committees, and encourages people to stall feed their cattle. They also promote small water harvesting structures.

INTEGRATED LAND & WATER MANAGEMENT :

A project for upland development, initiated by the International Fund for Agriculture Development (IFAD) at Bunded village of Kashipur block, and now undertaken by ***Agragamee*** an NGO is worth discussing. The following is a detailed account of the attempt of Agragamee.

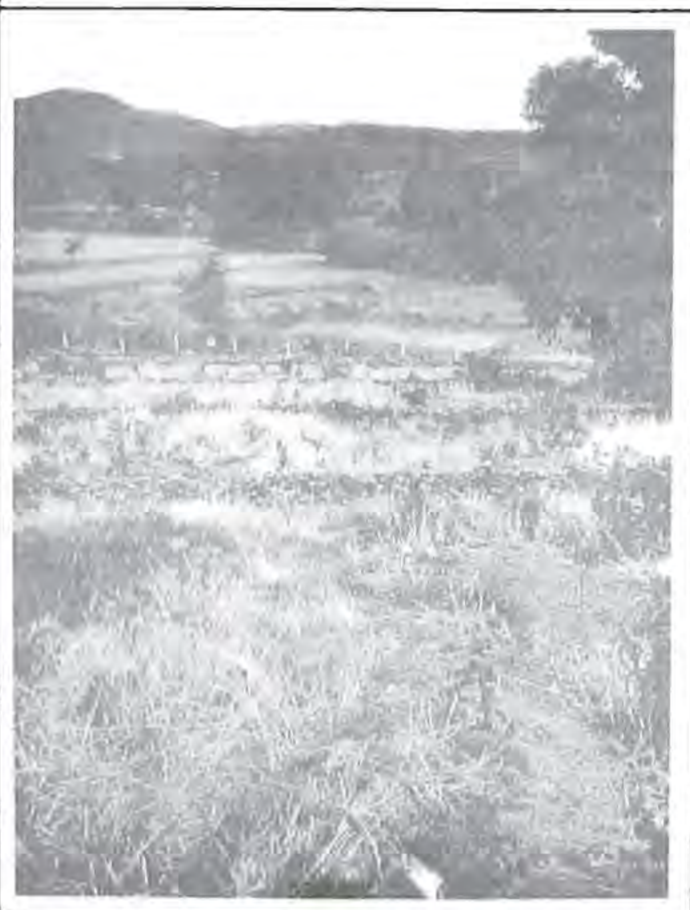
Silvi-horti-agro-pastoral crops : Both community land and marginal lands falling under 5th, 6th and 7th land capability classes are covered under suitable Silvi-Horti-Agro-pastoral crops. Inter planting between the tree rows are also done with suitable grasses and legumes for use as fodder. Agricultural crops like tuber crops, cowpea etc., is taken as intercrops to meet food requirement. Suitable shrubs or grasses for raising vegetative contour bunds are also used.

Tree in the cultivated fields : Lines of trees are planted around the field to protect the field from winds, give shade and enrich the soil with their falling and rotting leaves. Some N-fixing trees such as Acacia Nelotica or Leuraena trees are planted to improve the soil.

Pasture Development & Management : By planting lines of trees, the pasture lands are divided into several plots. The trees stop the wind & the pasture does not dry out quickly. By dividing the pasture like this, a better management of animals is thought of by putting them in different plots in turn. Leuraena, Calliandra, Sesbania etc. are planted as fodder trees.

Trees on the slopes : Bare stiff-slopes are subjected to erosion by the down streaming of water. To fight erosion, trees are planted along contour lines and cultivation, where-ever suitable, is taken up between the tree lines. Hardy fruit trees like Mango, Cashew, Annona, Ber etc., timber species and quick growing species for fuel, commercial plants like Bamboo, American silk Cotton, etc., are taken up for plantation. In between trees planted in contour, suitable grass/legumes are also planted, for use as fodder.

Vegetative Bunding : Planting of vetiveria, Sabai, Sisal etc. in isolation or in combination with bunds on contour is raised in mild slope lands. Such vegetative bunds raised act as retardant to run-off and help in soil and moisture conservation.



Pix : Ghani Zaman for CPSW.

THE KASHIPUR MODEL

Village "Bundel" - will show the path.

Pix : Ghani Zaman for CPSW.

Strip Cropping : Land with milder slopes (1% to 4%) are covered under strip cropping. Close growing erosion resisting crops like grass, groundnuts, black gram, green gram, cowpea etc. are planted in strip followed by erosion permitting (clean tilled) strips of row crops like maize, jower, cotton etc. in contour. Such contour strips are planted in succession. The erosion that takes place in the strip having erosion permitting crop is taken care of and silt is conserved in the next strip having close growing erosion resisting crops.

Planting In Contour : Simple planting in contour, raising ridges for row crops in contour help in erosion control, and moisture conservation.

Zero tillage approach : Zero tillage is an attempt to cope with soil erosion. Ploughing may be the soil's worst enemy, breaking it up and leaving it at the mercy of water and wind. Mulch from last years crop is a valuable tonic for soil. Planting on the terraces following the contour of the land, without ploughing or minimum plowing and leaving the last years' stalks and other residue on the ground as mulch that holds moisture & soil. The mulch left between the rows catches and holds the rain water, helps to suppress weeds save the cost of ploughing and inter-culture and promotes beneficial organisation. Compression of the soil by machine/animals is avoided, organic matter added, and the soil is protected from desiccating wind. Maize seeds are dibbled in contour in sloppy uplands, using last years stalk and crop residue as mulch.

Organic farming : This helps to fertilise with FYM and compost instead of chemical fertiliser. Mulching helps in controlling weeds. Crops are protected against pests and diseases by careful crop rotation, mixed cropping and inter-planting with plants which keep the insects away.

Inter-Cropping and Mixed Cropping : It is quite helpful in conserving soil and moisture by reducing run-off. In mixed cropping, deep rooted and shallow rooted crops are so associated that plant nutrients contained at different soil depth are properly utilised besides utilization of moisture conserved at different soil depth.

Cover Cropping : Soil loss has been observed to be directly proportional to the exposed soil surface. Cover crops such as Cowpea, Green Gram etc. are selected for conservation farming that besides providing good canopy, also help in enhancing organic matter content and fertility status of the soil.

Surface mulching : The pulverised soil mass on the surface is used as soil mulch but not during the rainy season when rains of high intensity are expected. Under such condition stubble mulching is very effective. Besides protecting the soil from direct impact of rains and thereby controlling the splashing effect and reducing the run-off and erosion, it enhances absorption of water into the soil, maintains favourable soil, temperature and humus supply and increases yield of crops. Mulching greatly helps in reducing evaporation loss of soil moisture

Wind Break Plantation : It is quite helpful to conserve soil and water besides protecting the crop against wind. The former is a barrier for protection from wind commonly associated with homestead gardens, orchards etc. while the latter is usually a linger barrier consisting of combination of trees and shrubs meant for protection of field crops for the purpose of soil and moisture conservation. For wind break, mixed plantations consisting of grasses, shrubs and trees adaptable in the area are planted at right angles to the direction of wind.

Gully Control by Vegetative Measures : To control the gullies, re-establishment of vegetation is of greatest importance. Vegetal cover for the control of gullies comprises of grasses, legumes, shrubs and trees either alone or in combination. Other measures adopted in the watershed area of the gully indirectly aid in gully control and retain the run-off.

Mechanical Measures : Some of the important mechanical land treatment measures are bunding, bench terracing, land levelling with field-bunding etc.

This very complex experiment by Agragamee has started and so far it has proved to be a success. Nevertheless one must keep's one's fingers crossed till the project is complete. Meanwhile care should be taken to see that people's land and forest rights are not infringed and necessary inputs are extended to them.

Natural Fencing will add nutrients and strengthen the bunds.



Pix : Ghani Zaman for CPSW

TOWARDS SUSTAINABLE AGRICULTURE

When the available land and energy resources are utilised in a proper manner, both ecological and economic sustainability is enhanced. A system approach involving integrated attention to crop and livestock farming as well to Agro-forestry and aquaculture will be helpful in generating more jobs and income. This will also protect soil health. But there has been no concerted effort to develop a sound package of environmentally safe farming practices that could be tested and adopted extensively by the farmers. The absence of such an organised support has left the farmers with no other option but to continue with the known techniques.

PROBLEMS TO BE TACKLED

- The biggest problem faced by most ecological farmers is that they do not know when and how to start switching.
- The transition stage possess a great challenge.
- There is no organised extension machinery to disseminate the proven technologies.
- In many cases basic information is not available.
- While proceeding to change the soil fertility, the farmers often ignore other aspects of the farming system.
- There are no immediate alternatives to chemical control available in the market.
- Simple changes in transition lead to complications in pest and disease management.
- Plant derived pesticides are there, but they are not as quick acting as synthetically compounded ones and therefore can not be efficient substitutes.

Nutrient Supply : Most of the times it has been found necessary to adopt an integrated system of nutrient supply to the soils that tend to be thirsty and hungry. Bio dynamic systems that can use compost and humus would be of great help to increase soil fertility.

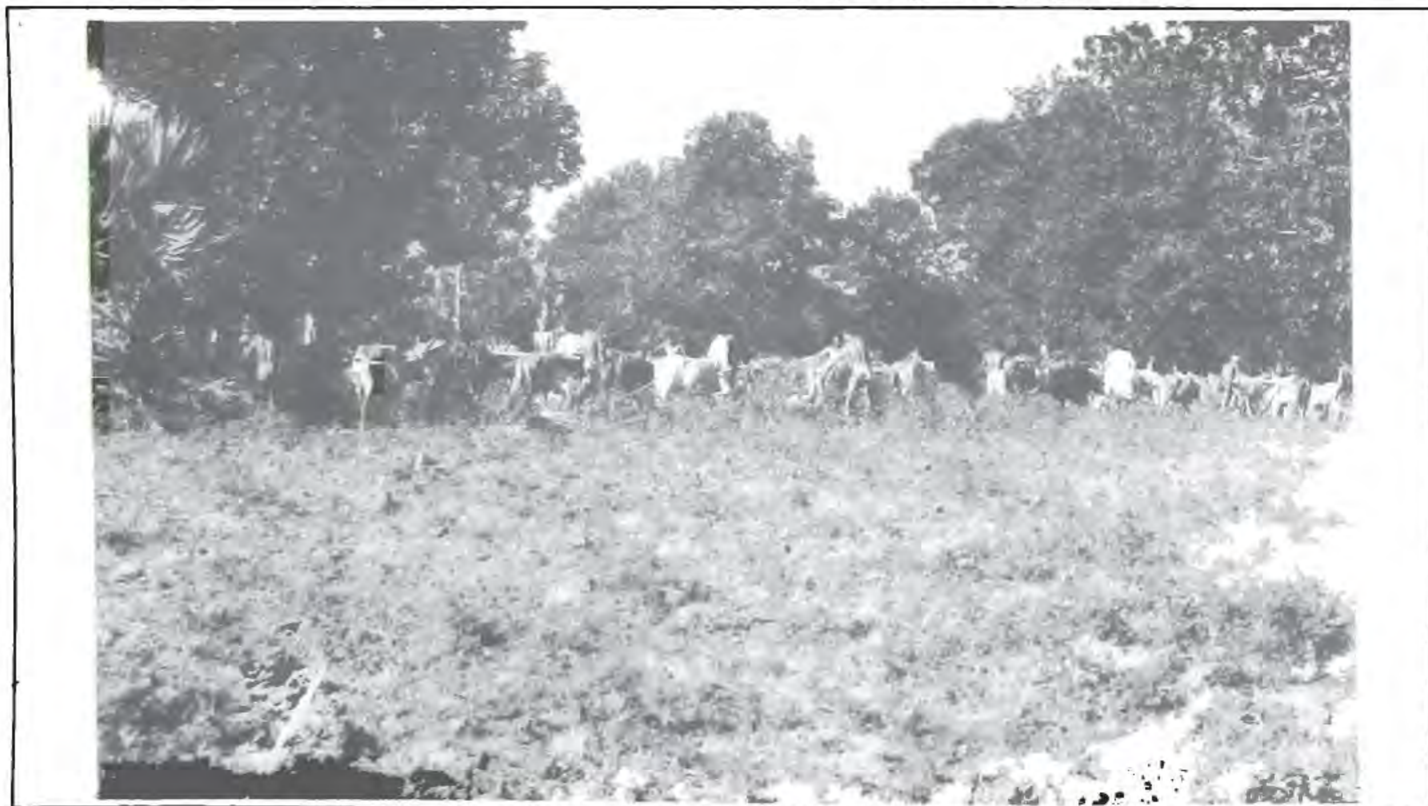
Table - 12

Consumption of Fertiliser in Different Districts (Undivided) in Orissa (Kg./Hect)

Sl. No.	District	Consumption of Fertiliser during 1986-87	1988-89	1991-92
1.	Balasore	23.6	26.0	37.9
2.	Bolangir	9.8	18.9	12.7
3.	Cuttack	18.9	29.0	20.8
4.	Dhenkanal	8.0	9.1	10.8
5.	Ganjam	22.5	36.1	28.6
6.	Kalahandi	1.8	4.3	8.6
7.	Keonjhar	7.4	10.3	8.8
8.	Koraput	7.7	10.4	9.1
9.	Mayurbhanj	7.3	9.9	13.9
10.	Phulbani	3.8	5.6	5.7
11.	Puri	21.5	26.6	25.5
12.	Sambalpur	51.3	54.8	35.5
13.	Sundergarh	13.9	17.8	11.1
	Orissa	16.4	22.0	20.0

SOURCE : Directorate of Agriculture & Food Production, Orissa, BBSR.

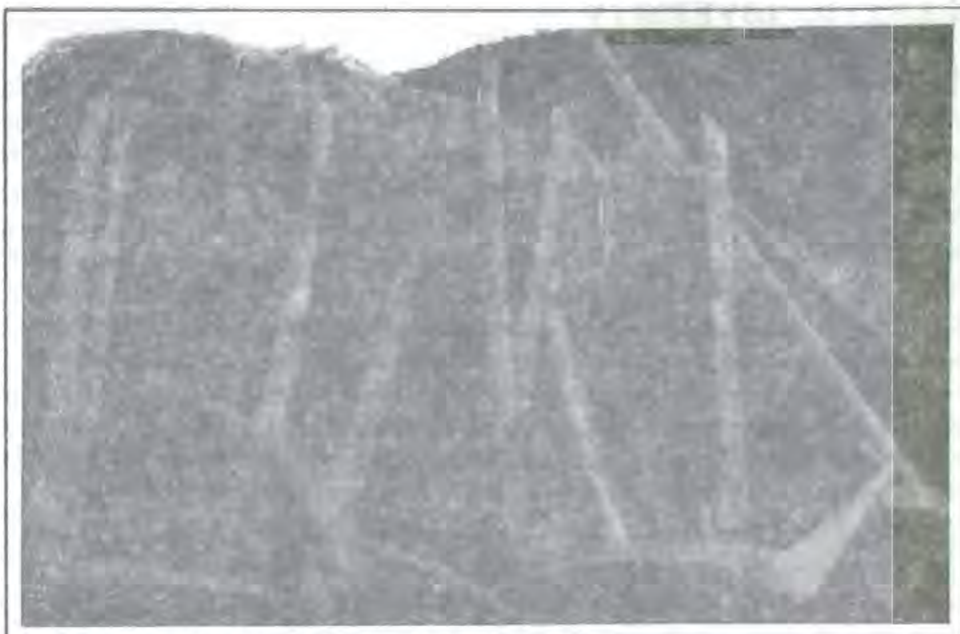
Wasteland management through community effort - by Koyas of village Telegudain Malkangiri district.



Pix : SEDP (Jeypore).

Chemical Fertilizers vs. Bio-fertilizers : Bio fertilizers are to be advocated as an alternative to chemical fertilizers whose use has been increasing day by day (one kg per hectare in 1961-62 to 22 kg per hectare at present). A overdose of chemical fertilizers can cause toxicity of soil and therefore Bio-fertilizers must be preferred. Besides there a number of bio-fertilizers which can enhance soil fertility. Blue green algalgae, Assail, Rhizobium and Azobactor are available for use as bio-fertilizer. Green manure can add biomass, supply nitrogen, improve physochemical fertilizer and control alkalinity and acidity of the soil.

Vermicomposing is another bio-technique that converts urban waste into manure by making use of earthworm culture under natural condition. It has a high quality protein that can be used in fish culture and various cropping patterns.



Indigenous Technologies useful for sustainable agriculture, need diverse timber species.

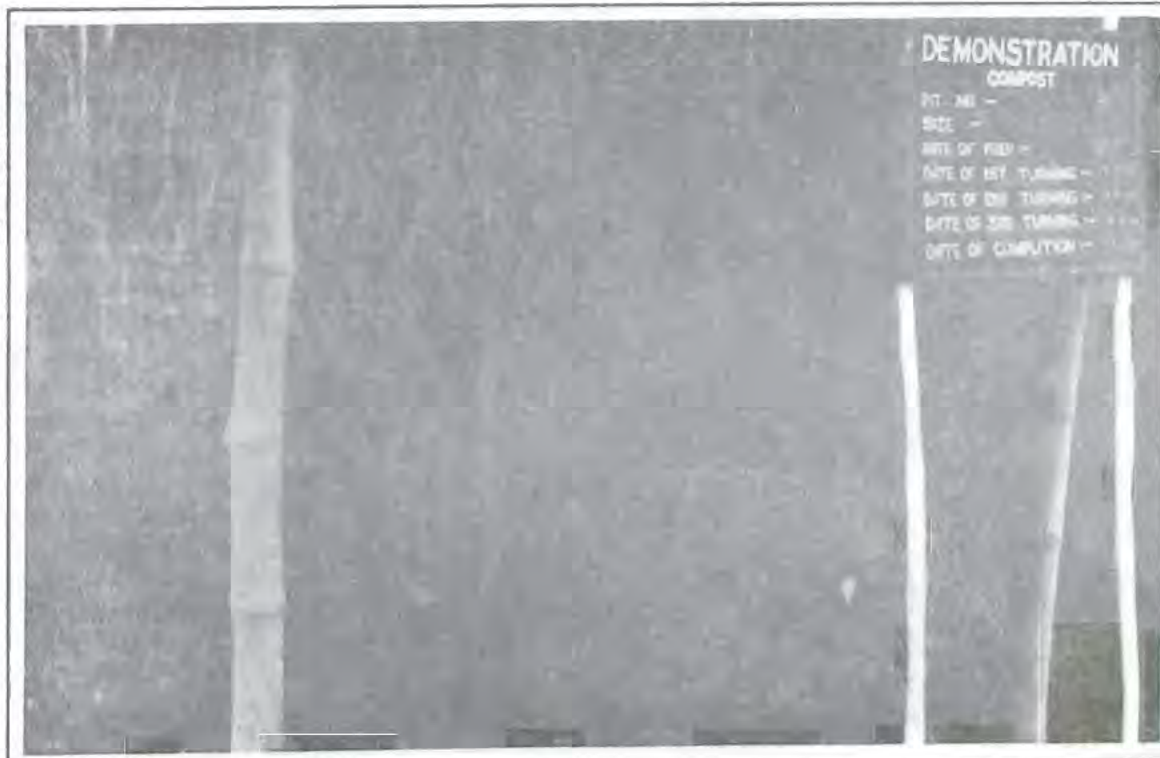
Pix : Sanjay K. Khatua

Pest management & use of chemical pesticides : An integrated pest management system is to be adopted. The conservation of chemical pesticides, botanical pesticides, etc. need to be popularised. Serious biological repercussions were found due to over emphasis on chemical control of pests and indiscriminate use of pesticides.

Plant extracts for Pest & Disease control : Studies indicate that neem *(Azadiracta indica)* and its derivatives can control rice bug population. Thus neem, marigold and Bougenvilla plants can be used as natural pest repellents.

Integrated Pest Management - A New Experience : The Integrated Pest Management strategy is an alternative method to the present day plant protection strategies. The concept and principles of Integrated Pest Management (IPM) were successfully demonstrated during April 1990 on summer paddy in vast areas of Pipili, Nimapara and Delanga blocks of Puri district. Cultivators were advised to use a tolerant variety UDAYA for summer season and sufficient quantity of seeds were made available to the farmers. The population of the pest was regularly monitored through intensive pest surveillance work, organised from the beginning of February. By the middle of March sporadic occurrences of the Brown Hopper Plant (BHP) was detected in the rice fields. A close watch was kept on the population dynamics of the pest through weekly surveillance and monitoring work. By the middle of April the population gradually rose upto the Economic Thresh Hold limit and in some fields it reached ETH. Yet the farmers were advised not to spray insecticides.

By the third week of April the BHP population reached an alarming proportion. Simultaneously parasites and predators also fed on the BHP. The experiment was gone through in spite of lot of external pressure & even some farmers defying instructions and spraying pesticides that destroyed the beneficial predators. The experiment proved that with natural predation the harmful pests can be controlled. The pest population, particularly that of Brown Plant Hopper, was regularly monitored and found to be attacked by natural predators growing in the fields.



Pix : Manoj K. Pradhan.

Bio-Compost - Cheaper and easier to make and eco-friendly. An effort for Sustainable Agriculture by CYSD in Tangi - Choudwar area.

GENETIC DIVERSITY

Genetic diversity is essential to achieve sustainable advances in productivity. Traditional systems of farming depended heavily on genetic variability which was mostly taken care of by women. Genetic homogeneity, which is characterstic of modern agricultural systems only leads to genetic vulnerability due to biotic & abiotic stresses.

Rush for High Yielding Variety Seeds : The scope for increasing agricultural production through extension of area under crop can not be increased indefinitely. Therefore, boosting crop production through intensive method of cultivation is called for. Improved technique and better agricultural practices are the only alternatives to be adopted by the state for agricultural development.

HYV's are today being increasingly used to boost agricultural production, throwing aside indigenous seeds which are not only suited to the climate of the place but also bear the brunt of all natural calamities. The signing of GATT has added to this menace threatening to curb the rights of farmers and create a food security problem even though there are assurances by all the authorities concerned that nothing will go wrong. All this does not augur well for the country and is being viewed with growing concern by social activists and environmentalist.

There is a growing popularity of such seeds among our farmers. But this may result in the extinction of native varieties within a decade. The 50,000 available rice species is expected to slim down to 50 different species by the year 2000 A.D. The huge and varied genetic potentials of different crops and horticultural plants are being curbed down by the advent of HYV seeds.

While the area under paddy has increased by 3.48% from 43.94 lakh hectares in 1986-89 to 45.47 lakh hectares in 1991-92, the area under high yielding variety of paddy has increased by 40.11% from 18.45. High yielding variety crops have made significant headway and has helped boosting up agricultural production in the state.

The rice area under high yielding varieties (HYV) has been steadily increasing from 5.58 lakh hectares in 1976-77 to 18.45 lakh hectares in 1986-87 to 20.31 lakh hectares in 1988-89 in Orissa. Correspondingly per hectare yield has increased from 735 kilograms per hectare to 1100 and 1237 kilograms per hectare during the respective years. This increase can be attributed to the use of high yielding varieties which basically demands higher use of inputs. Similarly the areas under HYV Maize, Jawar and Bajra except Wheat have shown an increase over the time as reflected in the Table.

Table - 13 : Area Under High Yielding Variety

Area in '000 hectares

Sl.No.	Crop	1976-77	1986-87	1988-89
1.	Rice	557.63	1845.43	2030.59
2.	Wheat	55.45	47	39.58
3.	Maize	32.66	80.13	88.30
4.	Bajra	0.26	0.86	2.88

The Orissa State Seed Corporation, is responsible for the production, distribution and procurement of HYV seeds in the state. In spite of considerable efforts made by OSSC, the farmers venturing for foundation or certified seed production have not gained popularity. There is a long way to go to achieve self sufficiency in HYV seed production. In 1985-86 the total paddy seed produced in the state was 23575 quintals while the amount distributed to the farmers was 34333.48 quintals. Paddy seeds had to be imported from other states. Table - 14 shows the amount of seeds distributed, produced and imported to the state in the year 1987-88



Indigenous seeds - A great heritage under threat of extinction - The future citizens are more conscious. Pix : GPC. Bhubaneswar.

Indian superfast rice variety Pusa Jaldhi Dhan 1,2 and 3 which matures in 65 days may wipe out farmers for ever in Kalahandi district, a hot spot for drought due to erratic monsoon.

Trials on these 'Super Fast' rice varieties at various locations in Kalahandi district have given encouraging results. Even with the erratic monsoon lasting for barely two months in Kalahandi, these varieties can give a bumper crop within 65 days of sowing.

Table - 14 : Distribution, production and import of different seed in Orissa in quintals during 1987-88

Sl. No. Name	Amount distributed	Amount produced	Amount imported
1. Paddy	65,362	30,020	35,342
2. Mung	7,951	261	7,690
3. Biri	6,040	—	6,040
4. Arhar	85	30	55
5. Groundnut	17,615	100	17,515
6. Nizer	510	10	500
7. Mustard	667	325	342

Action Plan for Seed Sufficiency : The Chief Minister of Orissa forecasted that there will be a requirement of 4 lakh quintals of paddy seeds during 1991-92 by the state. Against this, the Directorate of Agriculture and Food Production confirmed a requirement of 57,000 quintals during Kharif 1991-92 along with other non-paddy seeds.

A total of 40 Blocks in Orissa were engaged in seed production programme in 1991-1992. The target was to produce 1,50,000 quintals of paddy seeds (certified) for the market.


Farmers attempting "Zero tillage" method.

Pix :GPC, Bhubaneswar.

Constrains In Seed Production & Supply

1. Short duration paddy could not be procured for failure of germination due to eratic rainfall during Kharif. It was decided in the review meeting (held on 14.8.1989) chaired by the Director of Agriculture and Food Production, that the Departmental farm should produce location specific varieties. Similarly, due to late release of canal water in Mahanadi Delta, the harvesting of paddy coincides with pre-monsoon sowers and invariably seeds do not meet the specific standard for certification. As such the seed production of short duration paddy seeds has been taken up in the L.I. point Ayacuts of Jaleswar and Bhograi blocks of Balasore districts where the multiplication ration is high as the farmers are sustaining production level 7:8 tonnes of short duration paddy under higher management practices.

2. Regarding production of pulse except Arhar and Gram, the seeds of greengram and blackgram is also affected for the above reasons. However, pulse seeds production programme is taken up during September with low multiplication ratio to meet the seed requirement.

3. (a) The Corporation (OSSC) is self-sufficient in producing certified mustard seeds. (b) Til sown in September in Rayagada area is contributing towards self-sufficiency in foundation seeds and to a greater extent for certified seed production. The common practice of rotation paddy, potato and til could not meet the seed certification standard owing to late harvest coinciding with the pre-monsoon rain. (c) In case of groundnut seed production, there was constraint in availability of sufficient quantity of breeder seeds. The present availability of breeder seeds is to some extent satisfactory. Coordination between OUAT, OSSA and OSSC could help establish a seed chain, to the tune of 300 quintals of foundation seeds and further multiplication during 1991 Kharif helped in producing F-II seeds of 2100 quintals. It was anticipated that by the end of 1991-92 Rabi, the OSSC should have been able to supply 10,000 quintals of certified seeds of groundnut.

4. Steps are being taken to produce own breeder and foundation seeds by the Corporation.

New Varieties of Long Duration Paddy

Varieties like Jagannath and Savitri is not being accepted by the farmers. The OSSC has advocated the use of following long duration varieties released by CRRI & OUAT, during current Kharif.

1. Padmini	—} 145 days	5. Kalashree —}	
2. Dharitri	—}	6. Srabani —}	155 days.
3. Moti	—} 150 days	7. Tulasi —}	
4. Gayatri	—}		

Saline & Flood Resistant Varieties

FR 43/B FR 13/A SR 26/3

In a humble effort to start Natural farming - A training programme organised by Sambhab, Rohibank



Pix GPC, Bhubaneswar.

GRADUAL SWITCHOVER

The shift from chemical to ecological agriculture should however be gradual. A sudden switchover could discourage farmers from taking this course. It is said that at least six to seven years may be needed for this transition. During the transition period the farmer should build up a sufficient organic base to fertilize the field and improve the productivity of the soil. Crop yield of a high order can be ensured. Only then, will a state of ecological balance be attained and there would be a good number of beneficial organisms to check the explosion of pests and pathogens. The cost of cultivation can be brought down substantially as many farm grown inputs can be integrated efficiently into the farming system.

A study by the Agriculture-Man-Ecology (AME) Programme reveals some interesting features.

The switchover from conventional farming to ecological agriculture should be gradual and it needs three to four years for getting stabilised yields.

In the case of farms where high fertilizer and insecticide doses are used, the transition phase extends to seven or eight years.

If the switchover is rapid the yields will fall dramatically and the farmers may get demoralized.

Ecological farms tend to have more trees to meet the continuous demand for fodder and fertilizer and they provide stable incomes even during drought years.

From a purely ecological point of view, they have more diversity of species of plants, which invite different species of birds and beneficial insects.

CONCLUSION

B.B.Vohra wrote in his paper on "A Policy for Land and Water" (Sardar Pátel Memorial Lectures, 1980) "A surprisingly large number of our planners, politicians, policy-makers and economists still believe that there is nothing very much wrong with the manner in which we have managed our land resources all these years.

Proper management of land resources involves getting the best produce from existing good land, preventing more land from being degraded and reclaiming damaged land. The first priority should be given to increased productivity and to the prevention of degradation of more land. Reclamation of degraded land should be the next priority. Proper canal lining, effective field channels for regulating the application of water, and the provision of surface and sub-surface drainage are the three urgently needed measures for protecting land irrigated through canals. To implement such preventive measures one needs detailed planning, careful execution, huge financial outlays and a consolidation of holdings andredrawing of field boundaries. This is why anti water-logging operations make so little progress and why the blessing of canal irrigation is turning into a curse over large areas.

The fact that the Oriya farmers depend on annual rainfall is true. Agricultural production is a gamble. The increase or decrease of production in the State varies directly with precipitational behaviour. Thus, the necessity of managing rainfed agriculture is the clue to success in the field. An integrated land and water management approach (with watershed) has to be applied in these areas. It may be necessary to go for crop substitution. The necessity of harvesting a crop with its full production with low water requirement is very much awaited. This practice will help in including the marginal lands of the cultivators under active agriculture. The farmers of Orissa must be encouraged to make profitable use of non-cultivated land. The possibility of using them for pisciculture, duckery, diary, goatary etc., should be explored and supported.

In hill regions, very little low lands; but soil erosion and high water velocity makes it impossible to cultivate in rainy season. People make small channels and bunding. Pix : Manoj K. Pradhan, [illegible]



Rain forests of Koraput, part of Eastern Ghats (Dandakaranya Forests)

Pix : Ghani Zaman for CPSW

FORESTS

Orissa, owing to its peculiar geographical location and wide range of physical features, embraces a diversified floristic composition and consequently a vast economic potential. The extensive ranges of hilly forests, several lofty peaks, long stretch of coastline, excellent riverain system, brackish waters and coastal plains altogether have endowed the state with a wide range of ecological habitats for a diverse and broad spectrum of vegetation. The forests of Orissa have innumerable number of medicinal and economically important species, all of which need a scientific and sustainable management.

This is important, for degradation of forests are largely responsible for the change in climate over the land, variation in rainfall patterns, global warming and rendering of plant oxygen/carbon dioxide cycle invalid. It has also led to loosening of the soil, due to observe of roots and consequent erosion. This phenomenon is directly responsible for floods and droughts.

FOREST COVER OF THE STATE

The forest cover of the state has come down to less than 13% of the total area of the state as revealed by satellite imageries. Between 1972-75, the extent only of dense forests with crown density of 40% was 37320 sq.kms. An analysis based on 1981-83 imagery puts the extent of open degraded forest area, of crown density 10% to 40% at 24391 sq kms which according to the 1985-87 imagery decreased to 19384 sq kms, that is only 12.4% of the total geographical area of the state. The same report of '85-87, records the extent of dense forest cover at 27561 sq kms, that is, 17% of the State's geographical area. Discouragingly, this downward trend has been continuing. In 1991, the extent of degraded forest increased slightly to 19661 sq km, the extent of dense forests decreased to 27,349 sq kms, while the total forest area stood at 47205 sq kms.

A glance at the forest map of Orissa already shows that Phulbani district has the maximum forest cover in the state followed by Keonjhar, Sundergarh, Mayurbhanj, and Ganjam. Koraput and Kalahandi have forest cover only in scanty patches in the Southern, Southern-Western and Northern parts of Koraput and the extreme Eastern and Western parts of Kalahandi. It will be noticed that though areawise Koraput has the maximum forest cover (7,314 sq km), when relativized with the total area of the district, the forest cover is just 27% while that of Phulbani is 53.7% (1991). The reasons for the denudation of forest cover in Koraput are many. It will suffice to say that within a span of three decades the district lost as much as 7229 sq kms of forest on account of various developmental activities and resettlement of displaced persons and refugees.

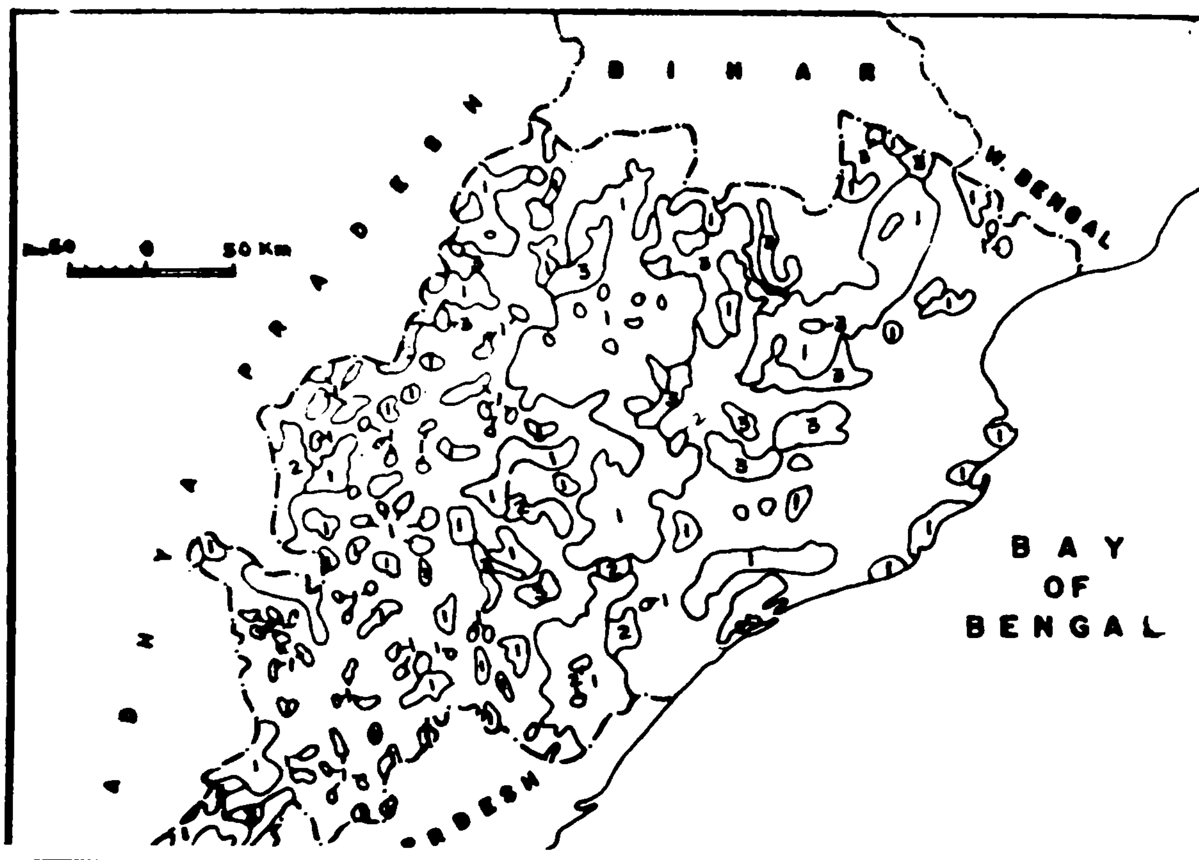
Table - 1 : Forest Area and Cover data Comparison

(Area In Sq.kms)

Year	Govt Recorded Forest cover	Source	Actual Forest Cover	Source
1972-75	67131.00	Bureau of Economics Statistics, Orissa	48383	NRSA Landsat Data
1980-82	59963	C.C.F., Orissa	34425	-do-
1986-87	55785	-do-	53163 (81-83 imagery)	State of Forest Report 1989-(G.O.I)
1987-88	55785	-do-	47137 (86-87 imagery)	Forestry in Orissa (A Report by Forest Dept. of Orissa)
1991-93	56142	Economic Survey 1993-94	47205 (1991 imagery)	Forest Survey of India, (G.O.I)

The coastal districts of Balasore, Cuttack and Puri are markedly devoid of forest cover, including the coastal areas of eastern and north-eastern Ganjam. On the whole, the map clearly shows that, the forest cover that Orissa presently boasts of, is concentrated in the central part and extreme northern and southern part while western Orissa is scantily covered and the east is more or less comparatively barren. Table - 2, fig.- 1 present the actual forest cover of the state.

FOREST CLASSIFICATION



Source : Forest Atlas of India.

Table - 2 : District wise Forest Cover of Orissa

Sl./No.	Name of District	Geographical Area in sq.km	Forest Cover - 1991 Assmt. Dense	Open	Mangrove	Total Sq.Km	Percentage to Area
01.	Balasore	6,311	258	92	21	371	5.9
02.	Phulbani	11,094	2,973	2,984	—	5,957	53.7
03.	Bolangir	8,913	534	534	—	1,098	12.0
04.	Cuttack	11,142	506	379	174	1,059	9.5
05.	Dhenkanal	10,827	2,392	1,274	—	3,666	33.9
06.	Ganjam	12,556	1,891	2,807	—	4,698	37.4
07.	Kalahandi	11,772	1,392	1,374	—	2,766	23.5
08.	Keonjhar	8,303	2,033	1,697	—	3,730	44.9
09.	Koraput	26,961	3,119	4,195	—	7,314	27.1
10.	Mayurbhanj	10,418	3,325	737	—	4,062	39.0
11.	Puri	10,182	1,567	760	—	2,327	22.8
12.	Sambalpur	17,516	4,635	1,539	—	6,174	35.2
13.	Sundargarh	9,712	2,724	1,289	—	4,013	41.3
TOTAL		1,55,707	27,349	19,661	195	47,205	30.3

Source : Forest Survey of India, Ministry of Forest & Environment, Government of India, 1991.

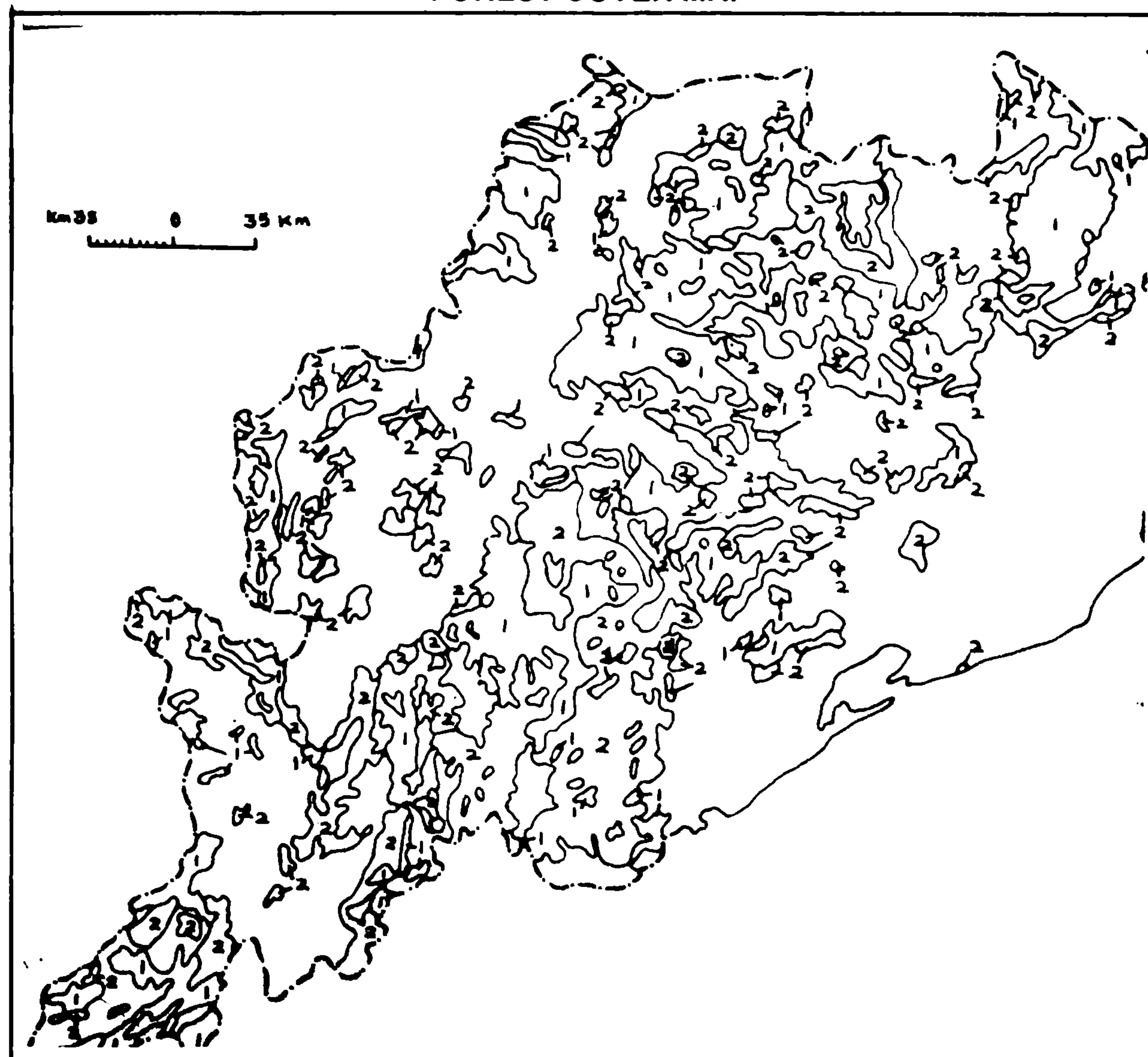
THE FOREST AREA CONTROVERSY

The Forest area of the state, is basically the legal forest area, not actual vegetation cover. Inter departmental conflicts between the Revenue Deptt and the Forest Deptt also pose a great deal of difficulty in demarcating the actual forest area of the state.

As per the record, the per capita forest cover in Orissa was 0.0022 sq.km in the year 1980-81 and has come down to 0.0018 sq.km by 1990-91. Per capita forest area has been drastically reduced over the decade(1981-91) in the districts of Balasore and Puri, the former having the largest decrease. Excluding Bolangir, Keonjhar and Mayurbhanj, the per capita forest cover is found to have fallen over the decade in all other districts. While the recorded data states that in terms of percentage of forest area to the geographical area in the year 1981, Ganjam was on the top with 55.9% followed by Phulbani with 52.9% in the state; in 1991, Ganjam had only 47% of its land area under forests, and Phulbani 56.2%, which incidentally is the highest in the state.

Problems with Forest Survey : Maps were published in 1902, establishing the concept of Demarcated Protected Forests (DPFs). In the state, the concept of reserve forest developed in 1878. All the modifications between this period and 1930, were based on the plain table chain survey, and not on compass bearings. So the total area computed and the actual field direction could not be ascertained exactly from the old records. Hence, numerous changes have occurred in the location and the extent of the Reserved Forests (RFs) notified. But, just before 1930, realising the difficulty in locating the exact boundary of the notified RF's both the compass bearing and the chain survey methods were undertaken together for later notifications. Yet the abstracts available, don't suffice entirely to estimate the total forest area existing.

FOREST COVER MAP



Source : Forest Survey Report. Govt. of India.

Table - 3 : Recorded Forest Area of Orissa (In Sq.kms)

Year	(Bureau of Eco.& Statt.)	(Forest Department)
1945 - 46	6895.00	6894.58
1948 - 49	43082.00	—
1954 - 55	45405.00	63969.40
1957 - 58	65421.00	—
1960 - 61	66851.00	67606.74
1967 - 68	67463.00	67463.39
1979 - 80	60224.00	60223.96
1985 - 86	55785.00	55784.48
1990 - 91	57183.00	57183.57

SOURCE : 1. Published in Environment Aspects of land use in Orissa. Seminar **Report**: By the State Prevention & Control of Pollution Board, Orissa/pp : 97.
2. Principal Chief Conservator of Forest, Orissa.

As a result of the merger of the princely states in Orissa, the forest lands in the ex-princely states were brought under the state Govts control in 1948. Subsequently, with the abolition of the Zamindari system more forest areas came under the control of state Govt. A rapid and steep rise in the forest area of the state is found during the periods 1945-48, 1957-58 and 1960-61, which can be attributed to two factors : in the year 1960-61, the ex-zamindari forest areas of 1500 sq.kms initially under the control of the state revenue department was actually transferred to the state forest department and the rise for the period 1950 to 1958, can only be attributed to the addition of forest areas from the ex-princely states. Between the years 1961-62 and 1962-63, there is a decrease of about 1707 sq.kms of forest area; and again between the years 1963-65, there is a steep and sudden rise till the year 1979.

The sudden fall in the forest area in the state during the year 1979-80 and subsequently 80-81, and then a trend of stability till year 1985 is highly confusing. The Annual administration Report of the forest department for year 1979-80 observed that 7419.82 km of forest reported, didn't actually exist in the field and hence, this much area was deleted from the records. In that year Koraput district (old) forest area shows a decline of 3,500 sq.kms from the previous year to the year 1982-83. This has not been reflected in the state's total forest area, which is perhaps corrected in the year 1985-86. Again, interestingly the forest area of the state increased in the year 1989-90. This increase is caused by the increase in forest area of Koraput district (old) from 7,249 sq.kms to 9010 sq.kms.

According to the forest deptt of Orissa, the total extent of village forest areas, declared by the state Govt is 27.10 sq. km. Ch.G.Mishra (Addl. P.C.C.F) reported that 13,966.97 sq.kms of Un-demarcated protected forests appearing on record is practically not identifiable. He says that these areas comes within village boundaries which needs to be ascertained. Virtually, this is difficult to recover and so, the actual forest area comes down to only 43,216 sq.kms which includes 1840 sq.kms. podu lands. This does not meet the criteria of 33% of the state's geographical area as Natural Forests as per the guidelines of National Forest Policy.

Most zamindary forests and other private forests were actually leased out illegally then. Scrutiny reveals that 39,154 sq.kms of forests have already been degraded. According to Dr.K.L.Pujari, most of these degraded forests may not be actually physically available to the Forest Department. Most crucial was the 16,355.00 sq.kms of zamindari forests. It is known that illegal pattas were issued at the time of merger in which case, the actual lands did not remain under the control of Forest Department.



Pix : Sanjay K. Khatua.

Forest lands are converted for agricultural purpose.

During the post-independence years many forest lands were distributed to the landless by the Govt. A reference to the agricultural statistics reports say that, increase in the net area for cultivation in the state was about 4800 sq.kms.

MANGROVE FOREST ENCROACHMENT

From the data available at different sources it is ascertained that the total area of the mangrove forests in the state has dwindled alarmingly by 42 sq.km. within a period of about 14 years, i.e. at the rate of 3 sq.km/year. In the assessment of the year 1989, based on 1985-87 imagery, it has been found that only 192 sq.km. of the precious mangrove forest on the coast line of Orissa, exist today. If this extravagant rate of decrease in the mangrove forest area continues, after few years, Orissa shall be left with very little, causing serious ecological imbalance in the coast and affecting the coastal habitats.

Investigation reveals the fact that as far back as 1952 all the forests of Mahakalapada, now a block headquarter in the district of Cuttack, were under the ex-zamindari, Burdwan estate. According to Orissa State Zamindary Abolition Act, 1951, this zamindari was handed over to the revenue department under Anchal (Tehsil) administration on 26th November, 1951. In course of time the Anchal-System was abolished.And with the abolition of the Anchals, the management of ex-zamindari forests of Dalijoda, Balarampur, Kalakala, Madhupur, Darpani, Kanika, Kujang, Harishpur, Marichpur, Dhaltang garh and Kaijanga were transferred to Athagarh Forest Division on 15th November 1957. But in the year 1980 Kanika range with ex-zamindari forest (16207 hectares of Cuttack district and 1027 hectares of Balasore district) was separated and came under the control of Chandabali Wildlife Conservation (WLC) division according to the Govt. notification No.8F (W 25/60-5369 FF & AH). It is learnt that the total area of forests of Kujanga Anchal prior to the vesting with the revenue department was 55,501 acres out of which 25692 acres of mangrove areas here had been leased out to the settlers from East Pakistan (non-Bangladesh) and Medinapore district of West Bengal and some local people by the zamindar. It is further known that nearly 7200 acres of mangrove forests were taken by Paradeep port during 1958 as per the political services department notification No.122P dated 6.1.1958. According to the Revenue deptt. notification No.1630-IX-52/55 DA dated 6.3.1956 five forest blocks like Hukitola (91800 acres), Balighar (2560 acres), Hetamundia (3920 acres), Yogindhar kud (1610 acres) were declared protected forests out of which Bhitar Kharnasi, Kukitola and Kantilo forest blocks were constituted as reserve forest in 1979. After these areas came under the forest department, 50 forest blocks were created in Kujang range out of which 20 blocks are mangrove forests and rest 30 are inland forest blocks. The mangrove forest blocks are Yogindharkund, Saralud, Nipania, Sanatubi, Hukitola, Jambu, Kandara-Patia, Sunitia, Bhitar-Kharnashi. A & B (two), pet chhela, Bagagahan, Kaunsipal, Kantilo and Sasanpeta. Of these some forest blocks, namely, Yogindankud, Saralikud, Nipania, Badatubi, Suniti, Petchhela, Baga Gahan and Kaunsipal are fully encroached where as other blocks are partly under encroachment. In recent years people have extensively encroached upon mangrove forest lands under Kujang and Rajnagar range. Local people and Bengali refugees living near the forest blocks indiscreetly cut the trees making the land clean for the purpose of farmlands, habitation & prawn culture.

However, the panic stricken people of the village Satbhaya under Rajnagar range cut and damaged Sunei and Rupei forest blocks with a view to rehabilitating themselves. Political patronage seems to have lurked behind the move to damaging the saline forests. In order to achieve paltry political gains the so called leaders who consider the Bengali refugees their promising vote bank are learnt to have inspired the latter to habitat on the forest land unlawfully encroaching it. A high level committee chaired by the then C.M. Mr. J.B.Pattnaik decided to evict encroachers, and demolish the gherrybunds. But the process was stalled due to stay orders/status-quo-orders from Hon'ble High Court & other courts.



Pix Project Swaraiya, Cuttack

Mangrove forests needs complete preservation.

FOREST TYPES OF ORISSA

Situated in the Northern Hemisphere, and within the tropics, the forests of Orissa belong to the Northern tropical forests type. The forest of Orissa, classified broadly as the Northern tropical forests are further divided into sub-classes, depending on the physiographical characteristics, dominant tree species, amount of mean annual rainfall and other climatic factors. They are hence divided into dry or moist forests.

FOREST TYPES OF ORISSA



Source : Forest Atlas of India.

TABLE 5 - FOREST TYPES OF ORISSA

COMPARISON OF DIFFERENT PARAMETERS IN RELATION TO THE INTERPRETED FOREST RESOURCES AND THE AGRO-CLIMATIC ZONES OF THE STATE OF ORISSA

Sl No	Name of the Agroclimatic zone	Elevation	Types of Forest as per Champion & Seth Classification/on Map units classified.		Location of the forest types	
1.	North-Central Plateau	150-300mts.	North tropical Moist deciduous forest valley • Sal Forest	• Moist Sal Savannah • High level Sal forests	• Bonai, Sambalpur, Paralakhemundi division	• Similipal hills, • Kalahandi Mayurbhanj, Phulbani, Koraput.
2.	North-Western Plateau	150-300mts.	• Dry peninsular Sal Forests	• Valley Sal Forest (Moist Peninsular Sal Forests)	• Seen throughout Orissa.	• Bonai, Sambalpur, Paralakhimundi division.
3.	Western Undulating Plains	150-300mts.	• Dry mixed deciduous forests	• Mixed deciduous forest • Dry teak forest	• Found in Bolangir & Khariar division.	• Seen in entire State
4.	Undulating Plains of Eastern Ghats.	300-600mts	• Dry deciduous scrub • Dry teak forest • Moist peninsular Sal (High level)	• Seen in almost all • Seral type of the moist deciduous forest • Found in Bolangir & Khariar division.	• Found locally in all hill slopes adjoining villages,	degraded high level peninsular Sal forest of Mayurbhanj, Keonjhar and Kalahandi.
5.	Eastern Ghats Southern Uplands	100-300mts.	• Southern tropical moist deciduous forest(teak forest) • Southern Moist mixed deciduous forest	• High level moist peninsular(High level)	• Seen in the Jeypore forest division of Koraput district. • Seen in Jeypore in Patches of Khariar div.	• Seen in Kalahandi, Mayurbhanj, Koraput, Phulbani.
6.	South-Eastern Region of Eastern Coastal Plains	600-300 150-100mts.	• Low level moist peninsular Sal Forest • I.tomentoss seral type of moist deciduous forest	• Tropical semi-average forests. • Valley Sal	• Angul, Puri, Nayagarh, Ghumsur division. • Mayurbhanj, Keonjhar, Kalahandi.	• Seen in Barnpurmal of Puri division and Cocha R.F.of Nayagarh division • Bonai, Sambalpur and Paralakhemundi divisions.
7.	East & South Eastern coastal Plains.	50-100mts.	• Mixed deciduous forest • Topical semi-ever-green	• I.tomentosa seral type of moist deciduous forest • Peninsular (coastal) Sal forest	• Found in entire state • In patches in Athagarh & Dhenkanal division • Barnpurmal of Puri & Cocha R.F. of Nayagarh div.	• In all degraded high level peninsular Sal forest of Mayurbhanj, Keonjhar and Kalahandi.
8.	North Eastern Coastal Plains	0-10mts.	• Mixed deciduous forest • Peninsular(coastal)	• Mangrove of Paradeep • Mangrove forest of Bhitarkanika Sal forest	• Fund in entire state • In patches in Dhenkanal and Athgarh division	• Seen in Paradeep locality • In Bhitarkanika area
9.	Mid-Central rugged ridge region of the state.	100-150mts.	• Moist peninsular valley-Sal forest	• Mixed deciduous forest • Peninsular (coastal) Sal forest	• Bonai, Sambalpur, Paralakhimundi division	• Seen in entire state • Available in patches in the Athagarh & Dhenkanal division
10.	Eastern-Ghats (North)	600-300mts. scrub	• Dry deciduous peninsular Sal forest • I.tomentosa seral type of moist deciduous forest.	• High level moist adjoining villages. • Valley Sal forest (Moist peninsular)	• In almost all hill slopes • Bonai, Sambalpur, Paralakhemundi division.	• Kalahandi, Koraput, Mayurbhanj & Phulbani.

VEGETATION OF GANJAM : A CASE STUDY

The forests of Ganjam covering a total area of 4698 sq.kms can be classified broadly into four types - The Sal Forests, Mixed Forests, Grass lands and Scrubs.

Sal Forests : Sal is an elastic species occurring in different plant communities in various frequencies. Sal forests occupy the greater part of the forest area of the district. Those occurring in continuation with the semi-evergreen type close to the moist valleys are classified as Tropical Moist-deciduous Forests (Champion & Seth 1968). The top storey in these forest consist predominantly of deciduous species but the second storey has some species of evergreens. The Sal is of good quality and commonly associated with certain special nature. The shrub layer consists mainly of *Ardisia solanacea*, *Barleria montana*, *B.Strigosa* and *Daedalacanthus nervosus* and the climbers are heavy types. The ground flora is rich and consists of several species of *Zingiberaceae*, *Compositae*, grasses, *Andrographis sp.*, *Dicliptera sp.*, *Justicia sp.* and ferns.

A patch of forests in Ganjam.



Pix : Ghani Zaman for CPSW.

Wherever conditions are hot and dry, Sal is of poorer quality and the forests are classified as Tropical Dry Deciduous (Champion & Seth 1968). Both upper and lower canopies in these forests are composed of deciduous species. This type has its own plant associations. The shrub layer consists of a few main species and climbers are also few. In certain pockets close to the sea and bordering Puri district, Sal attains very large dimensions due to favourable edaphic and climatic conditions. This is a subsidiary type classed as Coastal Sal and characterised by associates like *Elaeocarpus robustus* and *Amoora rohituka*. The ground flora is rich consisting of *Leea sp.*, *Piper sp.*, *Amomum dealbatum* and several ferns. In many valleys and other areas Sal is ousted by the growth of bamboo, either *Bambusa arundinacea* (Kanta bans) or *Dendrocalamus strictus* (Salia bans), resulting in almost pure formations of Bamboo.

Mixed Forests : Moist valleys and the steeper drier slopes and other places at lower elevation where drier conditions prevail are occupied by mixed forests. The mixed forests of moist valleys are named as Semi-evergreen (Champion & Seth 1968). These are characterised by large number of dominant species, mostly evergreen but some deciduous, heavy climbers and abundant epiphytes. On steep slopes below the ridges, Dry Mixed forests are found. Here Sal is usually absent while many of its associates remain. In lower elevations, the mixed forests are composed of different species which are recorded.

Scrub Forest : These have mostly originated as a result of biotic interference and can better be termed as 'Induced Scrubs'. Littoral scrubs are those found on the rocky faces of Chilka lake. These are resultant of dry conditions due to poor soil combined with strong sea winds and to some extent because of biotic interference also.

Grasslands : The upper slopes of the hills and their flat summits are mostly grassland. These are considered to be biotic sub-climax or plagioclimax, but it is also possible that above 1200 m their ecological status is of climax vegetation because there is no indication that in course of time, forest would again supervene naturally over these areas inspite of the least biotic interference at these high elevations.

(Table - 5 presents the type of forests existing in different regions/districts and agro-climatic zones of Orissa. In the next chapter on Natural Heritage & Eco-systems, the flora of the major forests of Orissa has been discussed in detailed as well as the rare and existing species. Case studies of vegetation in Ganjam and Koraput presents the scenario of Ghats and upland regions. The flora of Mangrove forests are also dealt in this chapter as well as next chapter).



Pix Sanjay K Khatua.

Kia plants are wildly growing in coastal districts .

FOREST TYPES OF KORAPUT

The forests of Koraput district fall under the category of moist peninsular sal, tropical mixed deciduous forests and dry teak forests (Champion & Seth, 1936), and *Shorea-terminalia-Adina series* and *Tectona-terminalia* series (Puri et.al., 1960). Southern tropical moist deciduous forests occur generally in the central and southern part of the district whereas dry teak type are found on the south-western side. Orissa Remote Sensing Application Centre, Bhubaneswar studied the vegetation of Koraput and has divided the forests into six vegetation zones as follows :

i) Motu-Mathili zone (intermediate teak belt)
ii) Boipariguda-Gupteswar zone (Bamboo belt)
iii) Balimela-Podia zone (Moist mixed deciduous forest)
iv) Pottangi-Koraput-Kasipur zone (Dry deciduous scrub belt)
v) Jeypore-Raighar zone (Moist peninsular sal belt)
vi) Laxmipur-Bisamcuttack-Chandrapur zone (intermediate between dry & moist deciduous forest)

Moist Peninsular Sal : The moist peninsular Sal types occur in the north western parts starting from Nowarangapur to Kundei. Dry sal types were also observed in few places like Beheda, Hatigam and Jharigan forests and the forest type is termed as dry type of Northern Tropical deciduous forests. The Sal type of forests extended upto Malkangiri and are not observed further south, therefore, the region around Malkangiri is the southern limit of Sal. Then, Sal *(Shorea robusta)* is replaced by *Shorea talura*. Sal occurs in different plant communities at the top of high hills. But the quality of Sal varies with the edaphic condition and therefore, its associates vary accordingly. At the base of the hills, Sal attains a height of 18 to 25 metres but on the top of the hill it becomes stunted and reaches a height of 10 metres only. The percentage of Sal may be as high as 70 to 80% in many localities. Pure stands of *Shorea* results from the exploitation of the mixed natural stands. As Sal is a vigourous coppicer and regenerates profusely in the openings, it gains dominance over other miscellaneous species.

Wet-Mixed Deciduous Forest : The wet mixed deciduous forest depicts closed forest community and the dominant species are mostly deciduous. A leafless period occurs in the dry season, more generally during April to May, when the upper canopy is entirely shed, while the lower tier remains green. An appreciable number of deciduous species come into new foliage before the monsoon, rather unexpectedly. Bamboo *(Dendrocalamus strictus)* is occasionally encountered. A vast stretch of forest belt in the form of inverted "V" shape is seen between Chitrakonda and Padia. It is also observed around Balimela and Machhkund reservoir adjoining Andhra Pradesh border representing the moist mixed deciduous forest. A few pockets of evergreen species comprising tall trees and a good numbers of lianas we found there. Dense forests are seen around Machhkund reservoir, Balimela, Nagasari, Sarangapali Turla, Konda Kamberu and Janlari Reserve Forests degraded forests are comparatively lesser in area than open forest. This is due to the low degree of human interference.

Tropical Dry Deciduous Forest : This type of forest generally occurs in the eastern and central part of the district. Tracts of exposed hills exhibit this kind of forest. The upper canopy in the climax type is closed, though usually uneven. It is formed by a mixture of trees practically all of which are deciduous during dry season, i.e. from February to May. Many of these species also occur in the moist deciduous forest, but the height of the tree is 10 to 20 metre only and the number of species are fewer. The undergrowth is also entirely deciduous in nature. Therefore grass species and other herbs have developed on the forest floor. Sal *(Shorea robusta)* is found in association with other trees. In this type, dense forests are not seen. The forests are mostly open or degraded. This is the result of poor edaphic condition and over-exploitation of dense forests.

Here, the tree layer is formed of *Terminalia alata, Buchanania lanzan, Chloroxylon swietenia, Dalbergia latifolia* and few others. Shrubs like *Woodfordia fruticosa, Holarrhena antidysenterica, Cipadessa baccifora, Flacourtia indica*, etc are predominant. Highland plateaus like Panchpatmali, Baphalimali, Potangi and Kodingamali area exhibit extensive grassland formation.

Intermediate Type of Teak Forest : The intermediate type of teak forest namely *Tectona-Terminalia* series occurs in the south western part adjoining Andhra Pradesh and north western part of the district adjoining Kalahandi district. This category of forest falls between the dry deciduous teak type and the moist deciduous teak type. This is intermediate between dry and moist teak types both in climatic condition and in floristic composition. It is also a deciduous multi-storeyed forest. The height of the dominant strata is usually 15 to 20 metres reaching 25 metres. The abundance of species varies according to the sites.



Pix Ghani Zaman for CPSW.

Forest types found in Koraput

A patch of Regrowth of Bamboo forests



Pix : Ghani Zaman for CPSW.

Bamboo Forests : *Dendrocalamus strictus* (Bamboo) in many places form the dominant constituent with a few deciduous elements. The western part of the district i.e. from Boipariguda to Mathili and Gupteswar bordering M.P. represent this kind of forest cover. Plants like *Diospyros malanoxylon, Chloroxylon swietenia, Lagerstroemia parviflora, Holarrhena antidysenerica and Helicteres isora* are the deciduous elements among the associates of bamboo.

Grass Land : The flat summits of the hills such as Panchapatmali, Baphalimali and Kodingamali are mostly grasslands. *Phoenix acaulis* also forms a dominant constituent among grasses. The important grasses occurring in the area are *Cymbopogon martinii, Themeda triandra, Apluda mutica, Arthroxon lancefolius, Eragrostis gangetica, E.ciliaries, etc.* Few herbs are also found scattered among the grasses.

Plantation : Plantations have been raised at a few places more vigourously in recent years. Agricultural plantations include horticulture and economic cash crops like Cashew *(Anacardium occidentale)*, Coffee *(Coffea arabica)*, Black pepper *(Piper nigrum)*, Cardamum *(Elettaria cardamomum)* etc. Several plant species have also been raised as avenue plantation along road sides and adjacent areas for the purpose of providing shade, fuel, fodder, fruits and light timber. Species like *Acacia auriculiformis, Cassia siamea, Cassia javonica, Pongamia pinnata, Eucalyptus citriodra, Ficus bengalensis, F.religrosa, Mangifera indica, Syuzygium cumini and Simarouba glauca* are notable in respect of their occurrence. Several forest species such as *Tectona grandis, Dalbergia sissoo, Gmelina arborea, santalum, Pinus roxburghii*, etc. were also observed as plantations within the notified forest areas. Sisal *(Agave sisalana)* are also raised on the barren hill slopes near Machhkund so as to prevent soil erosion.

Groves : Groves or orchards form a unit of vegetation type. These are generally found near the human settlements. Species like *Mangifera indica* (mango), *Artocarpus heterophyllus* (Jackfruit), *Psidium guajava* (guava), *Citrus spp., Annona squamosa* (O Atta), *Annona reticulata (O Ramaphala) are predominant.* Few groves or orchards are included in the built up lands due to their negligible area coveage.



Plantation Forests in Koraput

Pix : Ghani Zaman for CPSW.

STATUS OF FOREST GROWTH

The variety of the communities on account of varying physiographical habitats provides diverse microhabitats for occurrence of multitude of species of tribal use and economic importance. The forest has been so dense that outsiders fear to enter the area. Several tribal communities in their respective territory subsist on the existing forest communities. The interdependence of human and plant animal communities exist in perfect balance, according to Dr.H.Gadekar, Senior Scientist of the Indian Council of Agricultural Research Project based at Semiliguda, Koraput.

Market oriented economy played such a catastrophic role that the diversity, density and status of indigenous forest communities has reduced to degenerated scrub forest. As a result of this what used to be under thick forest before 4-5 decades has become totally bald. The hills on account of intense biotic interference carry dry deciduous scrub forest with potential to grow progressing to original climax community through secondary serial stages. Classification of degradation in Koraput District.

1) Remnant Forest communities ;	(a few)
2) Forest degenerated but with good potential of natural regeneration	(large)
3) Forest areas under active podu cultivation	(large)
4) Extremely degraded forest areas with rock out-crops	(dispersed)

Retrogression and degeneration in forest communities : Although 27.0% of area is reported under the category of forest, major part of it is totally denuded. Barring few patches in Chandrapur, Gudari and Muniguda subdivision of Gunupur, Narayanpatna, Laxmipur areas of Koraput subdivision and some

Teak replacement throughout Malkangiri



Pix : Ghani Zaman for CPSW

patches near Kundei, Khiloli, Umarkote and Maidalpur in Nowrangpur sub-division, rich and diverse climax forest communities have been totally destroyed and reduced to low scrub type dry deciduous vegetation. The natural potential of resurrection of degenerated vegetation though good, is affected by logging, repeated hacking, burning, podu (shifting cultivation) & grazing.

The state of forest communities has reached such a state that it is endangering ecological and economic system specially of the majority of tribal population.

Status of Forest Com-munities : As a result of over exploitation, all the three major forest climax conununities have been gradually degenerated to the stage of shrub growth. The varied habitats in the native forest in combination with physiographic variation provided a niche for the species of different habits and adaptabilities. The forests harboured great diversity of species used for food, animal fodder, wood, wood fibres, leaves, bamboos, canes, hill broom, gums, tannins, resins and a variety of medicinal drugs and herbs. Due to destruction of stratified canopy forests, many rare and unusual as well as commercially and socially relevant plant species are endangered and nearing extinction. Over exploitation of forest has not only diminished economic returns to the tribal community progressively but is also threatening the fabric of tribal economy and biotic diversity. Some of the commercially important species of forest stands have been relegated to isolated patches in few pockets of the district. Tribal economy sustaining species have been destroyed to such an extent that only coppice regeneration disturbed by repeated cuttings is prevalent at a status of shrub level. Medicinally important species like *Struchnus nux-vomica, Raulphia serpentina, Semecavpus anacardium* occur sporadically. Naturally occurring varieties of orchids have been exterminated. The forest traditionally provides genetic diversity of wild gene pool of crop plants like *Colocacia sp. Dioscropea sp. Oriza nivara Musa sp. Mangifera India, Artocarpus sp.* that once existed in the forest of Koraput district, has been dwindling. Annual and perennial weeds are gaining control of the forest ground at the cost of biotic diversity. One can notice dominance of weeds in so called reserve and protected forests. The weeds occurring in dominant proportions in all forest areas are, *Chlerodendrum viscosum, Cipadessa fruticosa, Lantana camera, woodfordiaium odoratum, Glycosmis pentaphulla pogostemon plecthanthiodos Zizyphus oenoplea etc.* In response to extreme biotic disturbance and degradation of land, *lantana camera,* and *Eupatorium odofatum* have gained dominance at many places. The condition and status of forest communities have been altered to such an extent that all most all tribal economy sustaining species have vanished or are existing at a stage of no economic return.

SAL FORESTS : MOST ENDANGERED

Some observers are of the opinion that Sal may vanish from the state. Sal is very sensitive. It does not regenerate if a critical soil moisture balance is not available. WDM Warren experimented on Sal regeneration in Chhotanagpur forests between 1939-45 and found that contour trenching (moisture recharge) helped the process of regeneration. A folk lore in Orissa says "where there is Sal there is water and no Sal no water". It is found that degradation of rich Sal forests leads to the disappearance of springs and water falls of the area. Sal seeds are very sensitive to germination, demanding a peculiar edaphic and micro-climatic condition and a rich humus layer for establishment. Forests where the tree cover has reduced to a critical minimum reducing the humus, mother trees of Sal are found without many off springs around them. Therefore it is essential that natural forests where Sal was dominant be protected by all means without cleaning the undergrowth to facilitate more germination and regeneration.

It would not be an exaggeration to say that a Mother Sal Tree is a nurse of other trees in a forest. Therefore indiscriminate removal of Sal would mean a pressure on other trees also. In the economic and ecological interest of the state natural Sal forests should be maintained with utmost attention and operation for Sal should be allowed only in high density areas sparing the Mother Trees.



Pix : Manoj K.Pradhan.

A patch of natural Sal forests.

FOREST WEALTH OF ORISSA

The forests of Orissa are the store house of many useful plants like Timber Species, Orchards, Rich Medicinal plants, Aromatic plants. About 33% of the total forest cover is predominated by Sal, while the rest is covered by species like Teak, Piasal, Bandhan, Kangada, Kasi, Sisu, Asana, Kurama and Dheura.

TIMBER SPECIES : The forests of the State embrace a large number of timber yielding species of which, Sal *(Shorea robusta)* predominates with about 43 per cent of the total forest cover. Other notable ones are Teak *(Tectona grandis)*, Piasal *(Pterocarpus marsupium)*, Bandhaan *(Ougeinia oojeinensis)*, Kangada *(Xylia xylocarpa)*, Kasi *(Bridelia retusa)*, Sisu *(Dalbergia sissoo)*, Asana *(Terminalia alata)*, Kuruma *(Adina cordifolia)* and Dhaura *(Anogeissus acuminata)*. Various types of Bamboos *(Bambusa)* Spp., *Dendrocalamus strictus, Oxytanenthera nigrociliata)*, Sal seeds and resins *(Jhuna)*, Kendu *(Diospyros melanoxylon)* leaves, Canes *(Calamus app.)*, Sandal wood *(Santalum album)*, Myriobalans *(Terminalia spp.)*, Salap *(Caryota urens)* and other minor forest products are some of the other important sources of forest revenue of the State. Sal and Bamboo forests, occur predominantly in Southern Orissa, Teak occurs naturally in the Koraput, Bolangir and Kalahandi districts along with a number of other valuable species. Ecologically, South Orissa is the meeting point of two giant species of Indian Forests - 'Sal & Teak'. Down South is Sal and towards North, there is no natural teak

ORCHIDS which have aroused a lot of interest from commercial point of view as well as conservational aspects are fairly common in different ecological habitats throughout the State. Of an estimated 1,200 species of Orchids in India, about 120 species occur only in Orissa including several rare ones. In view of the international attention riverted today on orchids, the Government of Orissa may initiate programmes for declaring orchid-rich forests (Similipal, Mahendragiri, Singharoj) as orchid-sanctuaries and set up an orchidarium to serve as a tourist attraction.

RICH MEDICINAL PLANTS : As many as 220 medicinal and quasi medicinal plants have been reported to occur in Gandhamardan hills alone (Panigrahi, 1963), though the actual number may be still more. The Similipal forests and the mythologically famous Gandhamardan hills are some of the potential sources of the indigenous herbal medicines deserving proper attention for thorough survey works. *Rauvolfia serpentine* (Sarpagandha or Patalgaruda) an endangered and important medicinal plant occurs in the wild in Orissa and can be utilised as a source of "reserpine" and "serpentine" - a traditional remedy for snake bite and cure for other diseases. Among others *Tylophora asthmatica* (Swasamari), *Strychonos nux-vomica* (Kochila), *Holarrhena antidysneterica* (Koruan) and *Centella asiatica* (Thalkudi) are a few other common medicinal plants of the state.

AROMATIC PLANTS

Kiya (Pandanus fascicularis) : Locally known as "Kiya" this plant grows abundantly along coastal Orissa, particularly in Ganjam district. Near Berhampur, Orissa, there are about 55 distillers, which distill around three crores of flowers every year.

Sal (Shorea robusta) : This is a common forest species of Orissa. Sal resin, on destructive distillation, yields an oil known as "Chua oil" varying from 41 to 68 percent. The resin known as "Dhup" or "Jhuna" is obtained by tapping the Sal tree. Sal resin oil is brownish yellow in colour and has an agreeable incense like odour. "Chua oil" is used as fixative for heavy perfumes and flavouring tobacco.

Citrus species : The flower, leaves and the rind of this species are aromatic. Citrus oil, is used extensively for perfumery purposes. There are potential areas in Koraput, Sambalpur and Ganjam districts where citrus production could be intensified. Wild lemon variety, citrus medica, locally known as "Jambira" grows wild in Similipal forest. The rind which is now being thrown away, if processed, could yield valuable oil essential for pharmaceutical use.

Vetiver (Vetiveria zizanioides) : Vetiver roots are excellent source of high grade perfumes. The grass grows wild in vacant fields and swampy areas.

Wild Lemongrass : Some variety of lemongrass are found growing wild in cooler hill regions of Similipahar, Koraput, Khariar, Kapilas and Ganjam district of Orissa. Due to the poor quality of oil no use has been found for this. But, this grass is mainly used for thatching purpose.

Hyptis swavelns : It is an annual herb, which grows wild in Orissa and the neighbouring states. The leaves contain 0.1 per cent essential oil, & the oil is rich in terrapins & low boilers.

DIVERSE & RICH MANGROVE FORESTS IN EAST COAST

The exorbitant and lucid growth of the flora of mangrove forests is the creation of five important environmental factors, namely - temperature, salinity, ftides, rainfall and wind. They have also undergone numerous adaptations of their own, to combat the adversities.

Mangroves are classical formations and consist of a complex group of plant communities, sustaining an unique eco-system surviving water logging, caused due to periodic tides and waves, massive soil erosion, widely fluctuating salinity, higher influx of solar radiation and strong winds. In about 500 kms of the coast line of Orissa, the tidal swamp forest extends from Chandipur coast in Balasore district to Gopalpur in Ganjam, either in a continuous belt or in distinct scattered patches or blocks. But, the mangrove forests are confined to only two places in the Cuttack district of the State, namely Kanika and Kujang ex-zamindary areas. Mangrove vegetation have a great economic potentiality and utilitarian value. As many as 38 Angiospermic taxa have been categorised as potential medicinal plants and having other economic value. Certain species like Bana ruar, are used for production of Tamrin, fish net, for timber and fuel wood while some timber is even used for boat building, bridge construction and house building purposes. A number of seeds, fruits and leaves are also reportedly used as fooding materials consumed by the people.

Saltbush Formation consists mainly of xerio herbs, by the littoral tract of Satavhaya and Gahirmatha, acting as sand binders and stabilizers which helps in checking erosion. It has been studied that the tidal range and the availability of light are two important climatic factors enhancing growth of the mangrove vegetation. The densely growing under shrubs make the forest impregnable. During the high tide, the masterland grasses and shrubs are submerged. The herbaceous mangrove vegetation are densely distributed in the intralittoral zone. The different types of zones and the width of the existing swamps are dependent on the types of the bottom contour, which is modulated by the action of the sea waves and the water current, which also controls sediment transport.

HISTORY OF FOREST RESOURCE MANAGEMENT

Earlier People used to enjoy forests in common, and never abused them for commercial purposes. Forest used to serve as places of learning where the monks used to have their Gurukulas.

It was during the British period that forest ownership went into the hands of the Government and commercial orientation began, with the requirement of wood for laying railway tracks and other construction activities. It was also thought that forest were an obstruction for cultivation and large scale denudation began.

In 1855 'the Charter of Indian Forestry' was issued, but was not implemented till the creation of the forest department in 1864 and the appointment of Dr.Brandis as the first Inspector General of Forests. Indian Forest Act of 1865, enumerates the provisions for declaring forests as reserved by extinguishing the bonafide rights of the natives. This was modified in 1878 and 1927. Under the provisions of the forest acts, forests were recognised as commercially important and monopolised by the British. Large scale plantation of cash crops, like tea, coffee, rubber, and commercial timber was undertaken. It is quite clear that most of these lands for the commercial plantations came from the destruction of natural forests.

The first formal forest policy came into being in 1894, based on the report of Dr.Voelcker in 1893, which was basically a detailed review of the 1876 and 1878 famines, and also included the plight of the alienated natives depending on forests for existence.

Post British Period : The forests remained in the state list, of the 7th Schedule of the constitution of India till the year 1976. The 42nd amendment of the constitution, transferred the forests from the state list to the concurrent list. But according to the forest policy of 1952, which proved to be a vital point in the evolutionary trend of forest management in India, the village communities in the neighbourhood of a forest was naturally permitted to make greater use of the products, for the satisfaction of their domestic and agricultural needs, (Govt. of India 1952). The availability of the naturally growing raw materials, declined for forest based industries and defence purposes. The National Commission on Agriculture (NCA - 1976) statement that "the free supply of the forest produce to the rural population and their rights and privileges, have brought destruction to the forests and it is necessary hence to reverse the process", showed the attitude of the then Government.

As per the recommendations of the NCA (1976) all forest lands were classified as Protected forests, Production forests & Social forests. Although the commission spoke of the rural population, it never bothered to look into the subsistence of the natives. The Social Forestry programmes of 1978 followed its 3 components of farm forestry, community woodlots and plantations on Government land. Research shows that of these, only farm forestry has been a success. In farm forestry too the favoured species was Eucalyptus.

Based on the recommendations, the 1980 forest bill was drafted and the Central Govt. used its powers drastically to control the forests over the states and promulgated the 'Forest Conservation Ordinance' which was issued in October 25th, 1980 (No.17 of 1980 Kulkarni 1983). This ordinance prohibited the state Govt's from allowing any forest land, for any non forest purposes, without the prior approval of the central government. This ordinance was later converted into the Act No.69, 1980, making it a most controversial act.

THE CASE OF ORISSA : POOR SHOW

The actual management of forests in Orissa started in 1883-84, when the 'Orissa Forest Division' came into being for the first time. Initially the division had only 267 sq.miles to its credit, but gradually demarcations for settlement and reservation were taken up. Orissa was separated from Bengal and a new state of Bihar and Orissa came into being in 1912, during which two more forest divisions had started functioning at Puri and Sambalpur. During 1936, the state of Orissa became independent. By this time, a total of four forest divisions existed in the state - Angul, Puri, Sambalpur (East) & Sambalpur (West).

The same year, the forest deptt was formed and brought under the administrative powers of the 'Conservator of Forests' at Angul. After the merger of the Ganjam district with Orissa, Ganjam Forest Division, which was initially attached to the Madras Province got transferred to Orissa. However, the forests of the Garjat states were under the administration of the Rajas. Some of the big states like Mayurbhanj & Bolangir - Patna, had full fledged Forest Departments functioning on terms similar to those in the provinces of British India. The Garjats were under a political agent with headquarters at Sambalpur. The Conservator of Forest, posted at Sambalpur, acted as adviser to these states in matter of forestry; a post held by Dr.H.F.Mooney for long. Orissa had already 9 forest divisions existing in 1947 under a conservator of forest at Angul. Forest management suffered a big set back as elsewhere & the situation became of grave concern.

HUGE SHORTFALL TODAY

Ch.G.Mishra, Addl. Chief Conservator of Forest, Orissa has estimated a huge gap between the demand and supply which has been worked out by deduction of about 30 per cent of bamboo requirement (i.e., 0.75 lakh M.T.) to be met from private holdings. To plan for self-sufficiency in forestry the gap by 2001 has been calculated. In this, the demand for bonafide uses of the people and that of the industrial sector have been taken together.

Table - 6 : Gap Between Demand & Supply (by 2001)

Category of Forest product	Requirement by 2001 (in lakh M.T.	Present level of Production	Shortfall
Fuelwood	141.28	1.35	139.93
Bamboo	4.34	2.5	1.84
Timber (in lakh c.m)	3.67	1.0	2.67
Fodder	343.66	(Not assessed)	343.66

SICKNESS OF FOREST BASED INDUSTRIES

The main timber based industries in Orissa are paper industries, manufacturers of furniture and structural wooden goods and sawmills. As is reported, out of the 4 existing large scale paper industries, three are malfunctioning due to the shortage of raw material. Only Straw Products Ltd. is functioning well. According to industrial sources, the capacity production of these paper industries has decreased tremendously, with the result that the cost of paper has gone up from Rs.11,000 to Rs.70,000 per ton. But some forest official sources inform that the complain about under supply of timber was not true. Also, it is learnt that the timber based industries are sick. Besides non-availability of raw material, sickness is the result of the conscious policy adopted in 1988 by the government not to give subsidies to industries and to encourage self-reliance among them. This state of affairs has primarily affected the large scale industries which had, till then depended on the allocation of lease areas at a subsidised rate. It is unclear as to how this situation has affected timber extraction by FD, since available data shows that timber production has in fact increased from 2.39 lakh cu.m in 1985-86 to 5.35 lakh cu.m in 1987-88, i.e. an increase of 123.8 per cent. It seems to be a plea by industries to increase the cost of paper and seek more and more subsidy from the Govt/FD.

REVENUE MAXIMISATION : UNSUSTAINABLE MANAGEMENT

Timber, firewood, and bamboo are considered to be the major forest produces. Sal, the most important timber in the state, constitutes about 60% of the total timber production. Usually the sale of timber is done by public auction or tender of coupes. In the case of OSFC, the sale is brought about by negotiations. Small timbers or poles are supplied from unreserved forests or village forest to the tenants and concession holders on the permit system. The 'Salia baunsa' (solid bamboo) is worked on a selection system, with a four year cutting cycle and the 'daba baunsa' (Hollow bamboo) is worked on a clear felling system with 10 to 12 years rotation. Most of bamboo forests in the state, has been leased out to the paper mills on a long term basis.

Table - 7 : Revenue Receipt from Forest Products.

(Rs. in Crore)

S.N. Product	1988-89	1990-91	1992-93 (R.E)
1. Timber	20.26	16.63	17.33
2. Bamboo	5.72	6.32	6.47
3. Kendu-leaf	23.64	76.85	77.43
4. Minor Forest Products	2.36	1.98	2.08
5. Others	7.25	7.30	8.07
Total	59.23	109.08	111.38

Source : Economic Survey, Government of Orissa, 1993-94

It is seen from the above table that forest revenue increased from Rs.59.23 crore in 1988-89 to Rs.111.85 crore in 1993-94 registering a growth of 88.8%.

Enugh of forests, but forest based industries are sick !



Pix : Samuel Gade for CPSW.

The Orissa State Forest Corporation Ltd. was incorporated in the year 1962 & was the first Public Sector Forest Corporation in the country, under the administrative control of the Forest, Fishery & Animal Husbandry Department. The total turn over of the corporation, which had been 16 lakhs of rupees in 1962-63, increased to Rs.95 crores in 1988-89 & Rs.174 crores in 1989-90. It has been found that the corporation has been in profit since the last few years after generating a non tax revenue of Rs.45 to Rs.50 crores as royalty. The payment of royalty from the year 1986-87 to 1989-90 (table- 8) is given below.

Table - 8 : Forest Royalty (Rs. in Crores)

Year	Timber	Kendu leaf	Sal Seed	Bamboo	Total
1986-87	19.64	15.69	1.63	—.	36.96
1987-88	24.62	22.98	0.69	—	50.09
1988-89	21.10	23.64	0.54	4.72	50.09
1989-90	12.38	82.44	0.74	4.44	100.00

Source : Orissa Forest Development Corporation, Govt. of Orissa.

It is seen that the royalty for timber is on the decrease after 1987-88. This can be attributed to the increase in forest conservational methods and hence decrease in yield of timber. Kendu leaf has increased in royalty from 1986-87 onwards due to the increase in prices of the Kendu leaf. For Sal seed, the decrease in royalty is attributed by the Government to poor fruiting, cyclonic rain, collection & fluctuation of Sal production. This policy of Govt. to earn more and more revenue without following a scientific management method has resulted in poor yield of our forests. Today, the yield of such vast forest areas is negligible.

Forest lands are becoming unproductive and completely barren. More and more pressure is resulting in over-exploitation. Though, the Government of Orissa decided to ban tree felling and is regulating it, it alone can not do this. Many people blame the forest officials for such a state of affairs today.

UNSCIENTIFIC EXPLOITATION OF BAMBOO FORESTS

Out of 16,347.95 sq.kms of total bamboo forests of Orissa 12,988.88 sq.kms which is approximately 75% of the bamboo forests has been leased out to the 4-paper mills in Orissa. The State Govt. had collected approximately 3.5 core rupees as revenue from the paper mills. Reliance on bamboo by paper industries too seem to be decreasing. However, in view of the findings quoted by the SISI that the production of bamboo is only 257,143 MT, as against the potential reserve of 750,000 to 800,000 MT, it may mean that bamboo extraction will be stepped up. The extraction of bamboo from leasehold areas by the paper industries is presented in table - 9.

Table - 9 : Bamboo Extraction by Paper Industries

Industry	Bamboo extraction (MT)		
	1984-85	1985-86	1986-87
1. Orient Paper Mills	83,835	105,540	109,715
2. Straw Product Ltd.	132,155	99,411	77,774
3. Titlagarh Paper Mills	52,766	39,222	12,654
4. Sewa Paper Mills	—	22,509	26,791

Bamboo exploitation is done by various agents. Though guidelines are laid for proper cutting, the cutters do not get adequate wages and other benefits, hence, they don't follow the guidelines and always try to maximise their income. In the process, most of our bamboo forests are becoming unproductive and the regeneration is very slow.

Plight of Bamboo Cutters & Bamboo Artisans :

Bamboo is another problem area. There is evidence of bamboo cutters being exploited by the corporation as well as the paper mills. Large number of bamboo cutters migrate to the neighbouring states in search of work although the 325 bamboo zones of the state has the potential of utilising the services of 10,000 cutters. In protest against the attitude of the J.K.Paper Mills, a group of people prohibited the transport of bamboo in some bamboo depots of Kalahandi with a 25 point charter of demands, making a strong point that the paper mills which utilise a lion share of bamboo for more than three decades have no participation in any development or welfare activities of the bamboo workers in particular & the state in general. The rural artisans depending on bamboo, (around a crore of them all over the state), have an uncertain future as they are not in a position to compete with the paper mills and there is no policy to supply them bamboo at a fair price. They only depend on the bamboo lifted by illegal means and made available to them cheap. An estimate says that more than 5000 of such workers in Sambalpur have an uncertain future. On the other hand, low wage forces people to cut more trees to earn more income. This kind of erratic bamboo cutting has reduced the bamboo forests.

Bamboo Nationalization and Exploitation has resulted in degradation of Bamboo Forests.



Pix : Ghani Zaman for CPSW.

It is a fact that Orissa has to import Rs.900/- crore worth of paper and pulp/year but this is not a plea to marginalise the bamboo cutters and artisans. The demand for raw materials of the paper mills can be met if they are asked to plant bamboo extensively in areas where they operate, thus creating employment for the bamboo workers, halting their migration and miseries. Although the Govt has nationalised bamboo trade expecting a 3.5-4 crore royalty/year @ Rs.600/-ton the common man is not going to benefit by it. It would be fair and just to see that bamboo is made available for marginal uses of every rural household of the state.

Bamboo use has an important role in rural socio-economic life.



Pix : Sanjay K. Khatua

MINOR (NON-TIMBER) FOREST PRODUCES : OF MORE VALUE

The forest economy of the state, subsistence economy of the forest dwellers and other workers and the fat income of the traders is dependent upon the total out turn of forest products. Besides Timber & Bamboo, non-timber forest produces such as kendu leaf, sal seed, lac, tassar, myrobalans, sandal wood, honey, animal products, drugs (many varieties), fiber and flosses, grasses, gums and resins, dye stuff, oil seeds, leaves, minerals, and other miscellaneous products have ample scope for exploitation and strengthening of the rural economy.

In Orissa, the forest Corporation licensed 820 saw mills of which 420 were closed by 1990 putting 8500 workers out of employment. The other 400 with 8000 workers and an investment of 24 crores required about 80,000 opts of wood, which was not available. The Corporation runs 80 saw mills by itself each unit requiring 50000 opts of wood every year. The corporation lifts about 2 crore opts every year a large chunk (80%) of which is given to other traders, affecting the saw mills and more than 2200 other wood based industries. Yet orders received for railway sleepers are not being supplied, losing a revenue of 4 crores while crores worth of Sal timber lies in many forest corporation depots awaiting destruction. Some reports reveal that the Rourkela Steel Plant uses 1 crore worth of wood every year from unrecorded sources. The revenue income declines as smugglers continue to send consignments of timber and firewood out of the state. Fire wood demand and supply have such a wide gap that apart from the domestic consequences it has affected the economic activities of people. For an example, an organised group of potters went on a rally to the SDO Angul on 23rd Aug.1990 and picketed there demanding fuelwood supply.

Mohua Flower & Fruits : Collection of Mahua flowers & fruit for utilization & sale has been a traditional practice of the people in all the forest areas of Orissa. Mahua flowers are used for food, fodder, liquor distillation & its fruit for extraction of oil. Considering the potentiality, Govt. of Orissa nationalised Mahua trade & opened purchasing centres in the areas where it is available in large quantities such as Sambalpur(260), Dhenkanal (155), Kalahandi (92), Bolangir (76), Ganjam (42) Cuttack & Sundargarh

Kendu-leaf Trade : At present Kendu-leaf is the single most contributor to the forest revenue. Besides, this has an important role in the political economy of the state. Collected in the summer, this leaf has immense potential for year long employment to rural landless people as 'Bidi' is essentially a cottage industry. There are 16 lakhs Kendu-leaf pluckers (12 lakhs being women) who are engaged in this. But the people who make bidis and collect Kendu-leaves are exploited in many ways. Some observers are of the opinion that this industry, managed efficiently and honestly can effectively help in poverty alleviation. In February 1994, in a meeting the leaders urged the Government to disclose the recommendations of the Baidyanath Mishra Commission. The Minimum Wage Advisory Boards advise that one paise per leaf be given to pluckers and Rs.7.50 per bundle for binding, are yet to come through. Some sources record that during 1988-89, 3,89,722.33 quintals of Kenduleaf was produced and was sold at the rate of Rs.1412.73 per qtl. Yet the condition of the people who collect the leaves and roll the bidis remained the same. The



Pix : Ghani Zaman for CPSW.

Kendu leaf trade influences significantly the socio-economic, and political life in Orissa.

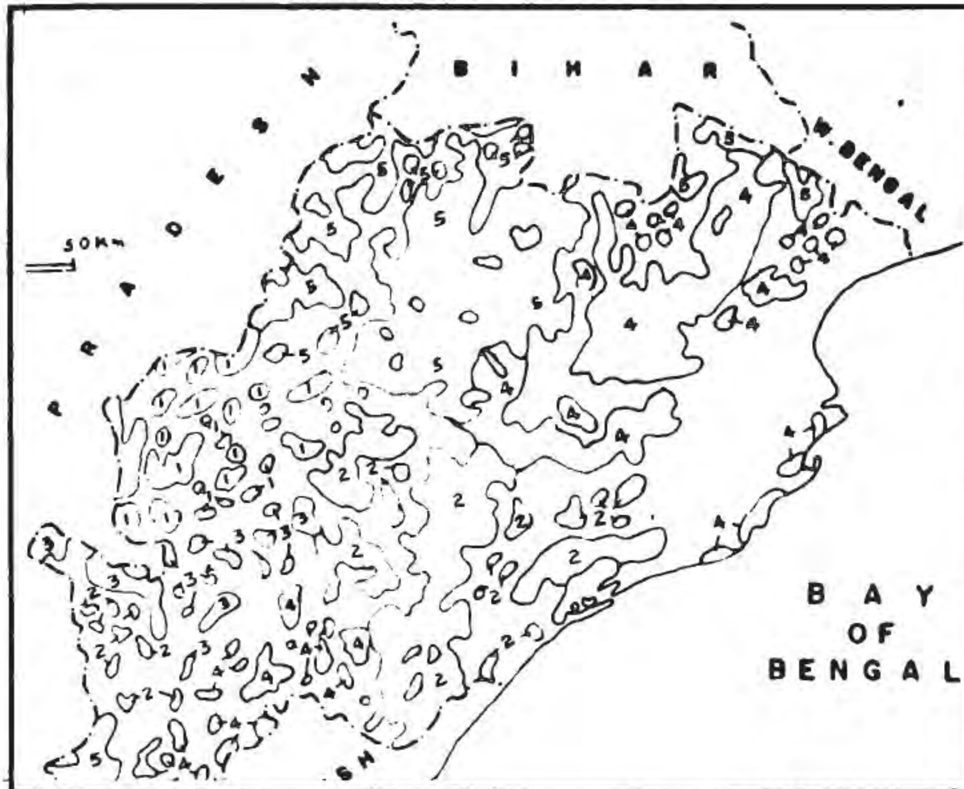
Kenduleaf trade unions have placed their demands and conducted agitations many times and have only made some marginal achievement. On the other hand corruption, smuggling and other means of money making continues. The Kenduleaf corruption and smuggling issue has also gone upto the assembly but no solution has been found out.

Oil-Seeds : Another group of products contributing to the economy of the forest dwellers and the state are the oil yielding seeds of which Sal is conspicious. Figures show that Sal seed collection has increased after nationalisation, but there are controversies. As many as ten different varieties of oil seeds are available on government records. The collection is highly fluctuating. In 1979, it was 72,000 M.tonnes which suddenly decreased to 11,000, and then increased to 1,27,000 in 1983. Though, again it came down to 29,000 in 1987, it was of the order of 84,000 M.tonnes in 1989. Some observers are of the opinion that sweeping Sal seeds clear may affect Sal regeneration while others defend it, but the fact remains that the tribal poor who had a mechanism of extracting this oil at home, now toils to collect and sell it to the agents and finally purchases adulterated oil from the local market.

Nuts etc. : The TDCC and the ***Mala Banijya Samabaya Samiti*** have taken the lease to market 29 varieties amounting to 8000 qtls. of nuts. 17 lakh rupees invested on a tamarind processing factory at Bastingia lies idle on the plea of lack of raw materials while tamarind seed powder is exported by other traders. Thousands of quintals of myrobalans (Harida) is collected without the knowledge of the government officials and sent to Polson (India) Ltd. at Amba in Maharashtra whereas a small portion is used by M/S Konark Tannins for manufacture of tannic acid.

The interstate tassar project beginning from 1981 with the assistance of Swiss AID, spent 268.56 lakhs for 2537 hects of Arjuna plantation. Four development centres, eight gamete stores, one cold store and market complex, one main and ten small tassar spinning and weaving training centres have been established. The second phase of the scheme started in 1986 and the third phase from 1992-93.

MINOR FOREST PRODUCE



Source : Forest Atlas of India.

VAST POTENTIAL FOR SMALL & COTTAGE INDUSTRIES : UNEXPLOITED

Cottage industries based on non-timber forest products (Minor Forest Product) can sustain the people who are depending on forest cutting and selling. This area of work has been given very little attention in the Industrial and rural development efforts of the state. The Annual Survey of Industries shows that there were 43 beedi industries, 6 factories manufacturing paints, tarnishes and lac and 8 manufacturing inedible oils in 1984-85. The largest number of beedi industries were in Sambalpur, which is the largest kendu leaf producing district. There is only one large scale industry based on beedi. i.e. the Konark beedi industry in the state.

Oil processing seems to be a major activity of NTFP based industries. However, in 1990, two of the main large scale industries based on edible oil seeds, i.e. Ambica Vegetable & Oil Complex and Orissa Vegetable and Oil Complex were sick and another, i.e. Utkal Oil Industry had closed down. A major development in the NTFP industry sector is the establishment of Utkal Forest Product Ltd. in Sambalpur district. This industry has recently (as per the policy decision on 4.12.'90) obtained lease for the procurement, processing, and marketing (oil only) for a period of 10 years from the FD, for 29 NTFP items. As per the recommendations of the SISI (1990) some more small scale industries based on NTFP could be set up. There are 20 more beedi leaf units, 15 polythened leaf plate units, using Sal leaves etc.

Tamarind has important potential as powder concentrate and starch but is now being sold unprocessed in Madras and West Bengal. One tamarind concentrate unit in Jeypore, one starch unit in Bolangir and one tamarind powder unit in Berhampur could be promoted.

One unit each, manufacturing inedible oils from palm rose, citronella and lemon grass could be set up in Koraput, Bhawanipatna and Berhampur towns. One unit each of eucalyptus oil, mahua seeds and soap nuts can be set up.

Medicinal herbs have immense potential and hence, at least 5 units should be set up altogether in Mayurbhanj, Sambalpur and Balasore. Nux vomica and Rona serpentina are available in plenty. Hence the present 2 units manufacturing homoeopathic medicines are not sufficient. Two more need to be set up in Sambalpur and Berhampur. Hundred quintals of honey is produced annually. Two small scale units can be promoted for the processing of these.

The present extraction of myrobalans is 10,000 quintals per year, whereas the potential yield is 25,000 tonnes. Much of the collected myrobalans go out of the state. 2 or 3 units may be set up to process these items.

5 to 10 units manufacturing ropes from sisal, 6 units manufacturing wooden electrical accessories, 3 units manufacturing match sticks, 2-3 units manufacturing briquettes from forest waste, 2 for manual instrument manufacturing, 5 units for agarbati sticks, and 2 units manufacturing katha and kutch can be set up in the state. Further, bamboo products, cane products, protein extraction from mushroom, broom stick works, rubber product, etc., have great potential in the small scale sector.

DEFORESTATION

To be more reasonable in the critical analysis of deforestation in the state, it is essential to deal separately with the varied factors responsible for the present state of forests in Orissa. Since independence, till the year 1984-85, the total deforestation in the state amounted to 207,405.37 hectors according to forest deptt. of which 54282.83 were reserved forests 30866.90 hectors were



State of deforestation - a patch in Bongamunda, Bolangir district.

demarcated protected forests and 122255.64 hectors were undemarcated protected forests. These included the river valley projects and subsequent resettlement of the displaced persons along with industrialization, capital construction, railways, minor irrigation projects; public purposes and roads. Of the total area deforested 4673.66 hectors are attributed to miscellaneous purposes. But these are the areas that support only the forest department records. Unlawful issue of illegal pattas by corrupt government officials showed many areas as non-forest areas.

Most of the senior citizens contacted all over the state are of the opinion that forests started dwindling after independence. Though actual area leased out for development projects was less, massive deforestation was the result.

Table - 9 : Deforestation Since Independence Till 1984-85
(Area in Sq.Kms.)

S.N. Purpose of Deforestation	R.F.	D.P.F.	U.D.P.F.	Total
1. River valley projects & resettlement of displaced persons	397.52	288.08	1170.16	1855.76
2. For Industrial purposes	31.49	2.84	0.15	34.48
3. For capital conservation	7.79	13.14	—	20.93
4. For railways	24.10	0.1	—	24.20
5. For minor irrigation projects	11.30	—	0.11	11.41
6. Public purpose	30.57	0.20	49.47	80.24
7. For roads	0.23	—	—	0.23
8. Miscellaneous Purposes	39.79	4.28	2.65	46.72
Total :	542.79	308.64	1222.54	2073.97

Courtesy : PCCF's Office/ Bhubaneswar.

Table - 10 gives a clear account of the degradation of the forests in the periphery of the reservoirs of multipurpose river valley projects as interpreted from land sat imagery by NRSA and by ORSAC. It is important to understand that once a multi-purpose river valley project comes up, it not only submerges a few sq.km. of forests, but causes massive deforestation in its periphery.

A study conducted on the Hirakud Dam Project area shows that between 1936-75 more than 45% of the reserved forests were lost around Sambalpur and Jharsuguda in a radius of 20 miles. Composing the forest area shown in old topo maps enlists the total area lost, the rate of loss and the impact of such a loss on the rainfall, relative humidity, temperature and other climatic factors including the silting of Hirakud reservoir.

Balimela project & Deforestation in Machhkund Basin : Nearly 1500 sq.kms. of mixed forests constitute the reserve lands of Machhkund basin and Malkangiri and Kalimela ranges. The forest is Southern moist mixed deciduous with bamboo strikes. It receives an annual rainfall of about 2000 mm. But much of the original forests of the valley has been submerged by Balimela and Sileru rivers.

Table -10

Degradation of Forests in the Periphery of reservoirs of Multipurpose River Valley Projects

(Area in Sq.Kms.)

Name of the project	Open degraded Forest 72 - 75	Open degraded Forest 80 - 82	Closed Forest 72 - 75	Closed Forest 80 - 82	Total Open degraded + Closed Forest 72 - 75	Total Open degraded + Closed Forest 80 - 82	Area without Forest vegetation
Hirakud	303	462	790	581	303+709 = 1012	462+581 = 1043	39
Machkund	475	513	795	696	475+795 = 1270	531+696 = 1209	61
Rengali	195	274	655	488	195+655 = 850	274+488 = 762	88
Salandi	321	401	1037	893	321+1037 = 1358	401+893 = 1294	64

Source : ORSAC / From NRSA interpretation of Landsat Imagery.

Machhkund river originates in the Madgal Hills high up in the Eastern Ghats in Andhra Pradesh and for the most part flows along the Orissa-Andhra boundary. It is known as "Sileru" after taking its main tributary "Guru Priyo" in the Konda-Kambera Reserve Forest. Ultimately, it joins Sabari river near Mottu at the meeting point of inter-state boundaries of Orissa, MP & AP.

1. Total land acquired for Balimela Project	42,500 acres.
2. Primary Forest Submerged	30,000 acres.
3. Private lands & Forests acquired	12,500 acres.
4. Total estimate of Primary forest completely destroyed or degraded since commencement of the project	46,000 hects
5. Afforestation by Forest Department	5073.891 hects



Pix : Manoj K. Pradhan.

The roads to deforestation : The new railway line to Koraput.

Dam Deforestation is immense; it is not only the submerged area.



Pix : Samuel Gade for CPSW.

Most of the forests around the dam are totally denuded. Tribals displaced by the dam project have resorted to extensive podu cultivation on primary forest. The Forest Department undertook an afforestation programme on 5073 hectare at a cost of rupees 70 lakhs by end of 1981. But they planted only Eucalyptus trees.

ORGANISED THEFT : THE REAL THREAT

Illegal feeling of timber perhaps occurs at a larger scale than legal trade of it. The luxurious requirements of the rich cannot be met by legal timber trade, therefore it is but natural that organised looting of our forests follow. This is carried out by an exclusive coterie of people - contractors, smugglers, the politically powerful, small time crooks - along with or without the complicity of forest officials. There is no estimate of how much of timber is lost this way but it is definitely done on a large scale given the report of timber smuggling from throughout the state.

Whenever a high voltage power line is to be set up thousands of trees are clearfelled along its tract. Once this process starts, not only is the tract clearfelled but areas in and around the tracts are cut down allegedly with the knowledge of forest officials leading to clandestine trade of timber. This is conspicuous in Sambalpur and Koraput districts. There is no account of how much of the forests have been lost in this manner.

Timber Trading and Deforestation : Timber trading is by far the most responsible factor for deforestation in Orissa, beginning from the 1st decade of the 20th century. For 43 long years beginning from 1917 to 1960 when its lease was terminated, M/S H.Dear & Co has been exploiting the Sal forests of Kotpad, Nowrangpur, Ramgiri, Malkangiri and Umerkote ranges. After 1960 the OFDC took over. Similarly, M/S Mottu Industries traded in Teak, Bija, Sisoo, Hallander etc. procured from the Malkangiri, Mottu and Ramagiri ranges which was leased out to it from 1937 to 1959. Besides, the Bissam Cuttack and Gudari ranges were exploited by M/S B.T.T. Co during its lease period, 1948-1953. The buyers were mostly contractors from Andhra Pradesh and Madhya Pradesh to whom the timber was despatched through the rivers Vansadhara, Nagavali, Machhkund, Sabari, Sileru, Indravati etc. It is these channels which have been used for legal and illegal trading of timber for decades.

There is a pattern to looting of timber. The coastal districts, especially Balasore and Cuttack have little or no forest cover at all and heavily depend on illegally procured timber. Puri and Ganjam have almost 1,13,557 hects of plantations and these are under constant threat from timber smugglers. Thus Nayagarh, Khandapada, Odagaon, Mahipar, Dashpalla and Gania forest areas are vulnerable to this threat. Sadly, the dense forest areas of Kusupalla, Hanumantia, Malati and Handiapara are barren today because of illegal felling.

The forest department has recorded 56913 cases of timber smuggling in the Ganjam-Ghumsar area. Of these 15571 were in North Ghumsar, 19212 in South Ghumsar and 17949 in Parlakhemundi. Large scale illegal trading in this area has done away with 80% of the dense forests of the Lakhari in Chandragiri range. Smuggling across the border to Andhra Pradesh from the Debagiri, Mahendragiri, Ramgiri Udayagiri and Mohana forests is a continuous phenomena.



Dhenkanal and Angul forest divisions too have not been spared. Legally and illegally Angul alone has contributed 10,66,122 hectares of forests to developmental projects in its area. Immense damage has already been done to the Malyagiri hill range of Pallahara while presently the Satkosia wildlife division is a paradise for illegal traders. Western Orissa is comparatively free from illegal timber trade because of the viligant villagers in this region. However looting from Deogarh, Lakhanpur, Debrigarh and Ushakothi sanctuaries have been reported. The Similipal raids have resulted in the seizure of wood worth lakhs. The indiscriminate cutting of trees in Bonai division of Sundergarh and Keonjhar is so open and done in such a highanded manner that neither the people nor the forest officials have been able to do any thing.

The prevention of the looting of timber is a gigantic task. Forest officials are handicapped with the lack of staff, of equipment and even by divisions within its own ranks. The nexus of the smugglers with political powers and their strong arm tactics weaken the forest force. But the greatest danger comes from within. While a sincere forester is attacked physically (reported at Barabara, Dhuanali and Ghumsur), kidnapped (Baulabandha), and even murdered (Pallahara), there are an abundance of cases of other forest officials actively conniving with the smugglers. In Ghumsur division, it is reported that the foresters share of the loot is fixed at Rs.30/- headload, Rs.75/-cycle, Rs.150/-cart of bamboo, Rs.100/-cart of wood, Rs.500/-truck. Village protection groups have acted as an impediment to smuggling but the fear psychosis and risks involved many a time divide the villagers united stand against looting. Yet strict vigilance by the forest officials and the active participation of the villagers can alone slove this problem.

TIMBER SMUGGLING : A CASE STUDY BY ANCHALIKA VIKASH PARISHAD

Illegal timber felling in the border areas of Kankadahad, Sukinda and Telkoi blocks of Dhenkanal, Jajpur and Keonjhar districts is as interesting as it revealing. A study conducted on this aspect by the ***Anchalika Vikash Parishad***, points to many significant facts on timber smuggling.

An area infested with mines and industries such as TATA, FACOR, OMC etc, the area has been subject to deforestation because of developmental activities as well as looting for the last 2 decades. The latter however provides a unique case study.

Located on the periphery of three districts, the three blocks provide easy ground for the timber smugglers since they are not strictly watched over by the district administration. Moreover, the failure to launch joint efforts by the three district administrations is to their favour. While they steal from Jajpur district, they escape either through Dhenkanal or Keonjhar districts or vice versa leaving a particular district administration helpless. This is facilitated by access to the National Highway which is connected by an express way from Daitari to Paradeep port and a state highway from Kamakhyanagar to Telkoi. The transportation of course varies from time to time. From bullock carts in villages, the wood is brought to a businessmen mediator by the smuggler, who then keeps them in an underground depot and dispatches them gradually on road. The Brahmani river is also used to transport logs to Jenapur, Paradeep and Cuttack.

Another interesting point to be noted is that the smugglers are concentrated in villages like Odisa, Anala, Kausargeda, Tipiloi, Dayanabili, Jamunakota, Surapatrapur, Ransela, Adipur etc and belonged either to the "paika" or "pana" caste. Thus it has become a profession for some villages. The mode of theft is well organised. At least a group of hundred enter the forest with arms and ammunitions and around 30 carts to transport the goods. These people are ofcourse the small time crooks while the people who get the majority of the profit always keep clear of this.

What is alarming is that the smugglers do not tolerate resistance and are prepared even to kill. First of all they try to undermine the protection movement by instigating inter and intra community conflicts. With lack of regional organisation among the tribals in these three blocks this has worked very well. Many of the local tribal leaders have given in to the tempetation of quick and easy money. In spite of this if there is any resistance they deal with it by intimidation, physical assaulting and even arson. It is reported that in a confrontation between the villagers and the smugglers, the latterset fire to some cottages in the villages of Podagara and Khuntapesi. Most shocking was the incident in which the DFO of Kamakhyanagar was murdered in his residence. Such methods have completely destroyed the morale of the people who do not get any support from the government or forest officials.

Happily however changes have been taking place. The present district magistrate conducted a series of raids in Jan '94 and seized truck loads of timber worth 3 lakhs from Banaspal village. Besides 800 CFT of timber and 9 bullock carts were seized from villages in Kankadahada and Bhuban blocks. It is expected that such efforts by those in power, the forest officials and the participation of the tribals can stop the exploitation of timber in the Kankadahada, Sukinda and Telkoi blocks.

PERMISSIBLE & REGULATED GRAZING

In a state, where the total forest area stands at 47137 sq.km as per the satellite imagery 1985-87, and all area is not allowed for grazing, the animal population put immense pressure on the natural forests.

The vast animal population which is so crucial to rural economy is heavily dependant on forests and therefore both the forests and animals have to be managed and regulated. Richer forests would imply richer feed for animals. Any restriction without the participation of the people would be disastrous. The rural mass needs to be trained, motivated and educated on the need to preserve forests for their own good and to provide food for their animals. A successful implementation of such a conscious policy can only regenerate forests.

Table - 11 : Grazing Statistics

YEAR	Total area of grazing land (forest)	Area of grazing allowed to cattle	Total No. of cattle grazing	Percapita grazing land available & allowed cattle (forest)	Total No. of grazer in state
1936-37	1810	1283.00	—	—	
1946-47	2012	1580.00	269,508	0.0058	
1954-55	10227.38	8277.85	497,753	0.01	
1956-57	65358.32	63074.64	326,556	0.19	
1961-62	6047.53	4224.62	859,046	0.0049	
1967-68	9302	7616	496,245	0.0153	
1968-69	36738	31744	246,885	0.0580	
1971-72	39166	32690	644,835	0.0506 }	17148000
1974-75	39343	28274	539,634	0.0523	
1979-80	28827.01	23676.64	369801	0.0640 }	18327000

Source : Annual administration reports of the concernemed years of Forest Deptt. of Orissa.

Shifting cultivation has also its contribution to deforestation.



Pix : Manoj K.Pradhan

NATIONAL FOREST POLICY :



Pix : Samuel Gade for CPSW

Logging - revenue maximisation and short-term Gains.

The National Forest Policy formulated in 1952 was revised in 1988-89, in which protection, conservation and development of forests has been stressed. It lays emphasis on environmental stability, conservation of Natural Heritage, creating people's movement for Forest regeneration and meeting the requirements of people from forests, and improvement of forest productivity. For the first time there has been a change in attitude to involve people in forest management. The important guideline of this policy is that 60% of the total Geographical area in hill lands and overall 33% of the total area of the state should be kept under Natural forests for ecological purposes.

AFFORESTATION

Considering the pace of deforestation, the needs of the people and the consequent impact on ecology, afforestation programmes have been undertaken in Orissa since 1968. Degraded forest lands and wastelands are brought under plantations for various purposes by various agencies in the state. But still the achievements are not significant. On the otherhand, no scientific as well as socio-econonuic principles are adopted while undertaking such schemes at the cost of crores of public funds. The rural afforestation activity in Orissa, dates back to 1962. Social Forestry as a concept, developed only when the SIDA assisted social forestry project started in April 1983. Later, the Orissa plantation Development Corporation was set up as per Govt. order No.7796/ dated 20th May 1985 to mobilise institutional finances, realising the inadequacy of the plan funds for recreation of forests.

To be more effective, it was decided to integrate the programmes of afforestation and plantation wing of the CCF and the OSFP, based on commercial principles, but at the same time, fulfilling the social and promotional objectives as well as getting funds from the various national and international agencies supporting the rural and industrial development in the state in particular and India in general was also a priority. The integrated OPDC and OSFC had to take up massive captive plantations jointly with the industrial sector in the state, promote individual plantations and motivate the people (i.e. the individuals, private and public institutions) for participation in the activities of the OPDC. By the virtue of the Govt. order No. 7796/dt. 20th May 1985, 9-social forestry divisions and 8-afforestation divisions, were transferred to the administrative authority of the Director - OSFP who was to work under the over all supervision and the administrative control of the chairman - OPDC.



To avoid any possible conflict between the commercial and the social objectives of OPDC, it was decided to keep the two wings separate. However, one can clearly see that all plantations are promoting commercial objectives only, without considering the ecology and needs of people. The afforestation divisions are raising plantations and after three years of nurturing, handing them over to the territorial wing for protection. The ecological objectives of maintaining the eco-balance, bio-diversity, soil and water conservation, meeting the diverse needs of people are totally neglected. It is demanded by people to follow a totally alternative approach to plantations in which the people will shoulder the responsibilities & the FD, NGOs and academicians will extend their support.

On the whole, in the state of Orissa, the territorial wing of the forest deptt. the OPDC, the OSFP (SIDA) and the SFDC are the prime sectoral divisions working for afforestation. The SFDC, although primarily set up for the development of the Similipal forests of Orissa, has also been handling commercial harvesting of the forest, to a limited extend and lately has embarked upon commercial plantations. The three Corporations of the state, dealing with forests, have presently been merged to form the Orissa Forest Development Corporation.

An effort by NGOs, Environmentalists and Govt. Officials to develop a suitable plantation strategy.



Pix : Ghani Zaman for CPSW.

PLANTATION ESTIMATION : BEYOND POSSIBILITY

According to Ch. G. Mishra, planning with a rotation of 10 years for fuelwood, 50 years for timber, and 4 years for bamboos, and with the present level of productivity of our forests the following programme of planting will be necessary to meet the huge shortfall by 2001 A.D.

Table - 12 : Necessary Planting Programme (for immediate 10 years)

Forest product	Annual Shortfall by 2001 (Projected)	Plantations required to bridge the Gap By Govt.	By Industries
Fuelwood & plupwood	139.93 lakhs M.T.	68,800 sq.km.	1200 sq.km
Bamboos	2 lakhs M.T.		
Timber	2.67 lakhs Cu.M.	1,335 sq.km.	85 sq.km.
Fodder	343.66 lakhs M.T.	Needs to be grown in Gochar land etc.	outside Forests, in addition to the forest
TOTAL		70,135 sq.km.	1285 sq.km.

To bridge the gap between the demand and supply Mr. Mishra suggests that plantations be taken up over 70,135 sq.km. by the State Govt. and over 1,285 sq.km. by the industries. In addition to this some high level agricultural land wastelands lying outside forests and all the gochar land available in every village needs to be planted up with fodder trees, shrubs, and grasses by the Village Community. Without getting into the accuracy of the estimate, the magnitude of the problem is crystal clear. Moreover the idea is almost impossible to tackle because of non-availability of so much forest land as well as finance. Hence, a radical rethinking in approach is necessary to initiate some radical action.

There are quite a few plantation schemes in operation. Among these are Economic Plantation, Farm Forestry, Rural Fuelwood Plantation, Silvi Pastoral Plantation, Afforestation of River Valley Projects, M.F.P.Plantation including Medicinal Plants, N.R.E.P. & R.L.E.G.P. (Now called JRY) Plantations, A.D.A.P.T. (Area Development Approach For Poverty Termination), D.P.A.P, I.T.D.A and Commercial Plantation, besides social forestry undertaken with different objectives in different areas.

Table - 13 : Forest Plantations under various schemes (OPDC)

Items	Upto End of 6th Plan	Total Upto end of 91-92
Plantation (in Hectares)	3,93,360	537,788
Rehabilitation (In Hectors)	75,340	127,518
Avenue Plantation(In Kms)	3,985	10,911
Distribution of Seedlings (In lakh Nos.)	539.07	716.84

Data's Source : Economic Survey of Orissa (1992-93)

SOCIAL FORESTRY

Social Forestry is a term used by the National Commission on Agriculture in 1976 to denote tree raising programme for the supply of firewood, fodder, timber and minor forest produce to the rural population.

In 1966, a state Govt. order was issued containing the principles for the land reservation. The order stated that during survey and settlement operation, at least 10% of the effective area in each village, should be reserved for village forest and other development purposes, including homestead. Thus a legal frame work for village forestry was created. This is supported by the 'Orissa Village Forest Rules' which gives rights to the people over their resources.

The social forestry project in Orissa is a part of general rural development strategy, which stresses self reliance by farmers and rural communities with regard to forest produce, in order to cater to their own needs. The project started on 1.4.1983 with Swedish Aid, mediated by SIDA and covered nine districts of Orissa, out of the total thirteen then, in the first phase of five years. The basic objective of the project was to create a rural based plantation and maintenance system for the benefit of the local population through sustainable system of forest management by the villagers themselves.

During Phase - I of implementation, village woodlots (18,669 Hec.), Reforestation (3,892 Hec.), rehabilitation of degraded forests (2,340 Hec.) and forest farming of rural poor (2,337 Hec.) was taken up. In the 2nd phase, 7500 villages & 75000 adivasis were covered under this project. The proposed outlay for phase - II was Rs.78.35 crores as against Rs.28.17 crores in Phase - I.



Pix : Ghani Zaman for CPSW

How social and How Forestry ?

MONOCULTURE & UNSCIENTIFIC PLANTATIONS

In the year 1985, the Prime Minister banned planting of monoculture species. Following this, all the states, including Orissa officially obeyed the ban. But field observations reveal otherwise. In practice government agencies not only plant monoculture species but also argue in favour of it. Forest officials admit that Eucalyptus (the prime monoculture plant) is being planted everywhere without giving a thought to its adverse impact. This increasing trend of planting monoculture species in Orissa was protested against by the "Life and Forest Movement", a forum of social activists and environmentalists. A study conducted by the CPSW - Bhubaneswar and commissioned by the Orissa Drought Advocacy Forum (ODAF) - Advocacy Cell in 1993 created a debate over this question. The study covered 99 villages of 10 block in Nowrangapur district and 60 villages of 7 blocks in Koraput district. Plantation of Eucalyptus and other commercial species in these study villages have been done by both Govt and private agencies. The OFDC alone has covered 4496 acres, that is, 40% of the total plantations in the study villages. Mangalam Timbers, a private agency has all its plantations in the relatively cheap hilly areas of Koraput district namely, Lamtaput, Boipariguda, and Kundra blocks. The plantations of both Mangalam Timbers and the Soil Conservation Department account for 48% (5392 acres) of the plantation in the study villages. All these plantations were done between 1971-72 and 1991-92.



Pix: Ghani Zaman for CPSW.

How economic are our Economic Plantations ? The value of the Natural forests are yet to be realised !

Teak Replacement : Teak plantations are gradually replacing the natural forests of Orissa. Though rich in plant density and community diversity, the Govindpalli forest range of Malkangiri is being planted with commercially and economically valuable species. Logging has destroyed many areas of the Malkangiri forests and thus has been replaced by teak. Similarly a big tract of Teak plantations is noticed between Angul and Tikarpada. Cashew, Tea, Coffee & Rubber are other varieties of commercial species which apart from Teak are replacing the natural forests.

Table - 14 : Monoculture & Commercial Plantations

NOWARNGPUR DISTRICT

Name of the Blocks	No.of study villages	Total Plantations (in acres)	% of comm. Plantation	No. of 100% Eucalyptus Plantation
Umarkote	20	1615	100%	10
Kaskumudo	3	266	100%	—
Jharigam	20	3175	100%	7
Papadahandi	14	1482.50	100%	6
Nowarangapur	20	1037	100%	8
Raigarh	8	445	100%	1
Tentulikhnti	5	91	100%	—
Nandahandi	3	23	100%	—
Dabagaom	6	1062.50	100%	2
Total	99	9597.50	100%	34

KORAPUT DISTRICT

Name of the Blocks	No.of study villages	Total Plantations (in acres)	%of comm. Plantation	No. of 100% Eucalyptus Plantation
Boipariguda	21	3362.5	100%	07
Nandapur	7	3015	100%	07
Similiguda	3	152.5	100%	—
Kundra	14	2343.5	100%	10
Lamatapul	9	772.5	100%	06
Jeypore	3	91	100%	—
Dasmantapur	3	575	100%	02
Total	60	11302	100%	32

CONVERSION OF CONSUMERS INTO PRODUCERS

Conversion of each (as many as possible) of the Confirmed Consumer to a Potential Producer by launching a massive motivation programme & providing necessary support is the immediate answer to the needs of people. By resorting to Green Fencing, Linear Plantation, suitable light-crown and nitrogen-fixing plants around field bunds are found growing in Ganjam, Nayagarh, west Orissa and Angul districts. There is a vast potential for these things. Plantation of trees in the homestead lands, road sides, around village tanks, canal embankments, etc. is another area that can be explored. It is also desireable to plant suitable tree crop in 29,83,000 ha. of high land cultivated area of the State. Though village commons are encroached, whatever is left, can be brought under suitable Tree Cover. Popularising fuel-saving devices, alternate sources of energy etc. and concrete Research and Development programmes in these areas should be taken up most urgently.

PEOPLE'S PARTICIPATION IN SOCIAL FORESTRY

To ensure people's management of forests, the project aimed at the constitution of village forest committees (VFC) taking representatives from the village panchayats. It is ironical however that no panchayat elections were held in the state till 1992 and hence the Sarapanch of the Gram Panchayat who was to be an ex-officio Chairman of the VFC did not exist. Subsequently, following the Panchayat elections in 1992, a few sarapanchas insisted, as per the provision of village forest rules, that they would chair the VFC. This claim was usually not honored and the dispute continued.

BSS Vs. VFC : The concept of Joint Forest Management has now been introduced in the state. Forest Protection Committees (FPCs or BSS), have been constituted to protect and regenerate degraded forests. While informal arrangements have been existing in the state much earlier, the BSS under the Joint Forest management have now been given formal status through a government order. In some cases there is an overlap of the two committees i.e. FPCs, and VFCs formed under the Social Forestry Project. In a few cases, the members of the two committees are common.

Role Clarity : While VFCs has been formed in all project villages as statutory bodies, the identity of the VFC as the crucial decision making body has not been very clearly established. Members inducted into the committee have in several cases accepted the formal role without any awareness or appreciation of their responsibilities.

Management Skills : Major decisions have often been taken by the projects's representatives at the village i.e. the VFWs and only formally endorsed by the VFWs as a routine process. While the VFCs may not have had any objections to the decisions, they don't on the other hand take any active role in the decision making process and thus the basic skill of management is not developed.

Participation in selection of species has been particularly limited. During the 2nd phase of the project, the preparatory work leading to establishment of plantation was formalised. This included the preparation of a Village Resource Plan through which the local needs and preferences were to be assessed. It appears, however, that the selection of species has been based largely on the availability of plants in the nursery. While in general, the species composition adopted have not been usually objected to by the community, they have not necessarily accepted it with any degree of eagerness either. The response of the community in such cases has been at the best indifferent. Creation of village woodlots on grazing land have also been perceived as an unnecessary intervention in local land use practice.

The preparation of the Joint Management Plan also has often been more or less, a routine step in the project. There has been practically no involvement of people in the preparation of JMPs. However, JMP provides an excellent basis for initiating dialogue on the management aspects and had the JMP been drawn up in a participatory manner as conceived in the project the right kind of skills in the management would have been developed.

Harvesting, Distribution & Marketing Arrangements : One important aspect that has not been considered in sufficient detail is the arrangement for harvesting and distribution of benefits. Wherever community plantations have been successful, villagers have received interim benefits in the form of broken branches, twigs and on a more regular basis dry leaves which have supplemented local fuel supplies. In such cases, ad-hoc arrangements have been made for collection and use of these interim benefits. These arrangements mostly fall into two broad categories - villagers are either allowed to collect these items for their own use based on requirement, or a small fee is charged by the VFC for collecting them. The funds collected remain as deposits with the VFC. In fact, dry leaves were invariably reported as one regular output from the community plantations. VFCs have been able to collect sums ranging from Rs.500/- to Rs.1000/- (per hect. of plantation) from the third year onwards depending on the area of the plantation and species planted (ORG Survey, 1993).



Pix : Sanjay K. Khatua.

Avenue plantation in social forestry : People have cut Eucalyptus as there is no participation.

Community people are only working as wage labourers.



Pix . Sanjay K. Khatua

to see if the community would be capable of making arrangements for restocking after harvesting. It is here that a lot of extension and follow up is required to ensure that a sustainable system of distribution and marketing is established, with reduced social tension and conflicts.

Participation of Women : The rules for formation of VFCs suggests that there should be at least one woman member. This practice has been adopted, invariably, but the woman members have really not taken any active part even in the related decision making process, which is vital for success of the project. NGOs do a good deal of work in bringing about women's participation at the grass-root level. The NGO involvement has to be expanded in this area. While the Government and SIDA are in the process of finalising the agreement for the phase - III, the role and scope of NGOs participation should be defined. Unless, this is done and people's participation is really ensured, the project may not be very successful. As it happened during last 2-phases, it seems that NGOs were deliberately kept aside. This should not happen in the 3rd phase.

PARTICIPATION OF NGOs IN SOCIAL FORESTRY

Participation of people in any development activity is essential to make it successful. To ensure that, the role of NGOs have been accepted as inevitable as the Government officials somehow don't find themselves capable of handling this aspect. Hence, NGOs assume greater role in the development activities which is same in Social Forestry as well. Nursery raising has been a rather easy job for the NGOs. The quality of seedlings produced by the NGO-raised nursery was found to be good. NGOs demand more locally useful trees, indigenous varieties and fruit bearing ones.

Plantation & Protection : The existing involvement of NGOs in plantation work has been very minimal and rare, but in some cases, NGOs have played an important role in the protection and maintenance of the plantation, in the control of stray cattle etc. There is a greater need for NGO involvement in the sphere of protection and maintenance.

Communication, Motivation and Training : In terms of creating a general awareness, the project has made some impact on the people. However, lack of awareness about the project strategy, modus operandi, technical information about plants, forest and environment are found in the project. The existing communication materials, media and strategy seem to be too inadequate for the task.

Conflict Resolution & Sustainability : Since no harvesting has yet been done from the project plantations, one can only speculate on the success of the prescribed distribution arrangement. Given a situation where the VFCs are not actually active decision making bodies, the process of distribution may create quite a few conflicts. Further, it would be interesting

EFFORTS FOR FOREST CONSERVATION

Regulating diversion of Forest lands : To check indiscriminate diversions of forest lands to non-forest use, the Forest Conservation Act, 1980 was brought into force w.e.f. 25-10-1980. As per the report of the ministry, the Act gave the anticipated results. The rate of diversion of forest land has been brought down from 1.5 lakh per hectare per annum to 6,500 hectares. To monitor the implementation of the stipulated conditions, the Government of India has set up 5 regional offices, one of which is at Bhubaneswar. In spite of such strict policies and laws, political interference and



Pix . Sanjay K. Khatua

Because of lack of participation, people cut the trees at early stages of plantations.

socalled development policies, have not been able to stop diversion of forest land for non-forest use. The most recent controversy is regarding the Beach Resort Complex on the Puri-Konark Marine drive. When all hotels are running a on loss & there are alternative sites for such a complex, the selection of the area on the beach which is ecologically very sensitive is sheer folly. Uncertainty reigns as the government is yet to take a decision. But it should also realise that the Beach Resort complex will not only affect a few wild deers or a wildlife sanctuary, it will completely change the coastal eco-system.

To check the violation of the provisions of the Forest (Conservation) Act, 1980, this has been amended to make the existing provisions more stringent. The scope of the existing definition of "non-forest purposes" has been extended to include therein cultivation of tea, coffee, spices, rubber, palms, oil-bearing plants, horticultural crops and medicinal plants. A further paragraph under "Explanation" has been added to include such operations which are ancillary to forest conservation, development and management as part of forest purposes as this was not mentioned in the original Act. The Act has become controversial on many grounds, most important for delaying development projects and abolishing the rights of the people on forests.

On September 4, 1985 concerned with the rapid depletion of forests in the country, the Prime Minister wrote a letter to all the Chief Ministers identifying specific areas of action to protect the natural forests of the country. The Prime Minister identified 14 areas of action & urged the State Govts to initiate actions. This was very well responded to by some states.

Ban/Regulation of Saw Mills : Though few states responded to the Prime Minister's letter and initiated actions to regulate/ban saw mills which is considered to be another major agent of timber smuggling, Orissa was not very responsive. For example there are always reports of wood smuggling from Maninag Forests of Ranpur area of Nayagarh district. People there informed that 12-14 saw mills are operating in one village, all are illegal except one or two. Many a time, police and forest officials have tried to raid the place, without success. The unfortunate victim of this was a very sincere forest ranger who was killed brutally in his residence in 1992. Nobody knows, what the officials have done after that. Other states like Madhya Pradesh have passed a special act to control the functioning of saw & veneer mills. Bihar formulated an ordinance for the regulation of saw mills. The ordinance has however, been stayed by the High Court. Gujarat has banned the establishment of new saw mills within 20 kms. of forests. Though such a ban or law doesn't always work, they can help the officials & people to take action against offenders.

CONSERVATION OF ECOLOGICAL FORESTS

Although as per recorded sources the forest area of the State is 36.72 % of the total geographical area, in real terms good forest cover extends only over 17.56 per cent. According to the National Forest Policy at least 33 per cent of the geographical area of the State should remain under ecologically sound forest cover for environmental purposes. According to a compilation of the National Mission on Wasteland Development, the extent of Wastelands in Orissa Forests is about 32000 sq.km. Taking into consideration the Eco-sensitive areas which has to be included in this, 9978 sq.km. of the recorded forest areas can be said to have become Eco-fragile deserving most urgent attention. The forestry situation in the State is classified as the following :

Now, saw mills are attracting the old and big (mother) trees as the forests are vanishing fast.



Pix : Sanjay K. Khatua

Ecologically Sound Forest (with good crown density i.e., above 40 per cent)	: 27,349 sq.km.
Ecologically Sensitive Forest (with poor crown density i.e., above 10 and below 40 per cent)	: 19,661 sq.km.
Ecologically Fragile Areas (Wastelands inside forests i.e., areas where the crown density is below 10 per cent)	: 9,978 sq.km.
Mangroves	: 195 sq.km.
TOTAL	:57,183 sq.km.

Most of the Reserve Forests and bulk of the Demarcated Protected Forests of Orissa are now under scientific management as per Management Plans. Sal forests are spread over nearly 10000 sq.km. (about 2000 sq.km. in Eco-sound zone and about 8000 sq.km. in Eco-sensitive and Eco-fragile zones). There is also about 27000 sq.km. of miscellaneous forests, that is 13000 sq.km. of forests containing Bamboos, 5 sq.km. of forests containing Sandalwood, 1300 sq.km. of forests containing Khair, 700 sq.km. of Teak, etc. In order to achieve the objectives of NFP steps shall have to be taken to put another 24,553 sq.km. under good forest cover besides maintenance of the existing 27,349 sq.km. of good forest as such.

Forests on the Path of Monsoon : The monsoon flow in Orissa is presented and discussed in the chapter-5 on Drought as well Water Resources. "Similipal" is considered to be the Amazon of Orissa. The rainfall and climate of Orissa is largely influenced and dependent on this. So far, the fluctuations in rainfall is not much in Mayurbhanj and nearby areas. Another forest range "Deomali" situated in a high altitude gives a break to the monsoon flow and enhances rainfall in Orissa which has been severely degraded mainly due to mining operations. This has become a major reason of drought in west & south Orissa. These things need more scientific study and conservation measures.



Pix : Jagadish Pradhan.

In plains & plateaus, people have started their own farm forestry to meet their needs - an effort by Banabasi Sangha, a local VO in Komna Block.

"Sink" Forests : One major forest zone consisting of few main forests like Ushakothi, Meghapal, Manibhadra etc. play an important role in absorbing the pollutions emitting from Industries situated around it. Major industrial zones such as Angul-Talcher-Meramundali and Rourkela-Rajgangpur are situated on both sides of these forests. These industries emit gases and can bring a total imbalance in the temperature and climate of the regions unless these forests are prevented from being clear felled.

SPECIES CONSERVATION

This is the need of the hour. The rich bio-diversity of forests is undergoing constant deterioration. Developmental activities like jetty construction, construction of roads, prawn farming, rehabilitation and resettlement of people, embankments and to a lesser extent, climatic aberrations are modifying the habitat and thereby causing serious damage to the species population and bio-diversity of the coastal estuarine ecosystems. Likewise the semi-evergreen forests of the Jeypore-Potangi hill ranges are changing to moist deciduous type due to human interference. Sal, the dominant species and the mother plant which exists in harmony with different plant associations is gradually denuding. In such a situation artificial regeneration is impossible and therefore conservation of them is an urgent need.

But lack of exhaustive information and taxonomic survey make species conservation a difficult task. The need for scientific data to understand the minimum population necessary for the species to survive genetically is also required. Since, basic distributional data on eco-systems or species are not available, one approach could be to locate areas either priority or representative for long-term conservation. Such areas could be selected on the basis of edaphic conditions i.e. soil, slope, altitude, rainfall, duration of dry season, temperature regime, land use history, potential vegetation types etc. Moreover, there is a need for undertaking survey and exploration of species in inaccessible areas. All this could be published in a red data book like the one published by the Forests and Environment Deptt. of the Govt. of India.

NATURAL REGENERATION & CLOSING OF HILL SIDES

Notified Forest land with crown density less than 0.4 & above 0.1 are ecologically sensitive forests which need to be protected properly. As per the State of Forest Report, 1991, about 19661 sq.km. of eco-sensitive areas are available in Orissa. Out of this, 11,158 sq.km. (of eco-sensitive areas) have already been identified on the ground in the different Forest Management Plans. In these areas, singling out the coppice shoots and gap planting with bamboos and other indigenous species is permissible, because sometimes plantations could do more harm. Hence, it should be allowed to regenerate naturally.

In spite of intense over exploitation and biotic interference, the regeneration potential of communities remains unhampered, as far as coppice regeneration from existing stumps are concerned.

Even forests with less crown density have potential for regeneration. Thus natural regeneration has taken place in many areas excepting patches where podu cultivation has been practised for a long time. It is heartening to note that even a valuable species like Santalum album (Sandalwood) has been naturally growing in Koraput and Rayagada forest divisions. This points to the fact that there is no need for expensive plantation programmes with less chances of survival, wherever root stock is available. Nevertheless this is what the government has been doing in the forest areas of Mayurbhanj, Meghapal, Gandhamardan, Nayagarh and Lakhanpur. Such felling of natural forests and biotic interference for the sake of achieving plantation targets should be sincerely checked. This needs participation of the people in monitoring the programmes of the government and quick action on the part of the latter, against erring officials.

However no studies have been carried on this aspect of revegetation of the hills. The soil depth and rainfall characteristics allow establishment of secondary forest quickly which can in course of time lead to formation of climax forest stands. However the population pressure and repeated over exploitation sets in repeated retrogression and arrests the progress formation of a secondary forest and later of climax forests. Nevertheless, it still possesses a good potential for regeneration and species diversity. The Economic status can also be improved greatly. Root stock is a valuable potential capital having capability to pay compound interest in terms of fast growth.

SUSTAINABLE FOREST CONSERVATION & DEVELOPMENT : A TURNING POINT

Forest conservation must first of all be viewed wholistically. To look at forest as only the source of timber (i.e. money) or pulp (i.e. producing paper) is to take a lopsided view of it. The forests are not only a source of wealth but also useful in maintaining the macro climate, micro climate as well as the ecological balance. Hence, the National Forest Policy's decision to conserve 33% of our geographical area as natural forests must be given first priority. Moreover, truncated policies which prevent the tribals from entering into the forest or even collecting forest produces from it needs to be changed. The danger to the forest don't come from the tribals but from the timber smugglers, poachers and forest officials whose illegal trade must be stopped forthwith. Simultaneously the government should recognise the rights of the tribals and give them access, power and control over forests. While the maintenance of the biological wealth and diversity of the forests needs strong political support, that these forests are the source of subsistence for majority of population should not be over looked. This is perhaps the only hope to regenerate the forest, natural eco-system, culturalvalues and community organisation systems to make it sustainable.

PEOPLE'S MOVEMENT TO PROTECT FORESTS

The spontaneity, enthusiasm and mass based effort of self motivated and self organised people to protect forests of their areas is like a light shining in the midst of the darkness of forests and a landmark in the history of forest conservation in India. Though localised the movement is widespread and began as long back as 1930. A 1990 survey indicated that there are at least 1200 village level organisations involved in protecting forests covering 1,80,000 acres. However, others observe that as many as 10,000 village level organisations are engaged in forest protection.

The success of these movements may sound like a fairly tale, nevertheless they are real. The cases of Masigoan, Birighat, Tureikela, Sareikela, among others, prove the point. During the 1984 parliamentary elections people were instigated to cut down plantations on 500 acres of the Kelei Forest reserve, as result of political rivalry. For two days tree felling took place. But Keshab Nayak, a youth from Masigaon rose to the occasion, formed a group called the Madhusudan Sanskrutik Anusthan and organised awareness programmes with the help of the district collector against the felling of trees. With songs and dances in the local language and padayatras, the people were motivated to stop cutting and start planting trees. The result, within the next three years the Kelia forest reserve was regenerated.

At Birighat, the movement took a tragic turn. To stop the constant smuggling of timber from the Gochiki, Dangar, Kudal Dangar, Chita Dangar and Birighat forests, Lokdrusti a voluntary organisation of the area inspired the people to protect their forests. The village Yubak Sangh under the leadership of Kumar Khan mobilised itself to ward of the smugglers. The village Jagruti Sramik Sangathan dug a trench round the forests to prevent it from animal grazing and later the villagers apprehended 7 bullock carts of the



Pix : Sanjay K. Khatua.

Babul tree is growing extensively in many areas of Orissa, specially the dry areas.

Kendu leaf department and 5 carts from Khariar, carrying timber. A compromise was tried to be arrived at by imposing a fine of Rs.2000/- but this was not agreeable to the villagers. Failing this the smugglers resorted to strong arm tactics, beat up Kumar and Mohit Khan, the leaders and created a fear psychosis in the village with a display of arms and ammunitions. The villagers yielded to this pressure and let go the carts. This incident of 1986 is a lesson that in spite of people's participation support from the law and order authorities is a necessity.

The action of villagers of Tureikela and Sareikela is significant. In the former, a village level Sangha called "Jamki" launched an effort to conserve 80-90 acres of its bamboo forests. They appointed two watchmen who were given Rs.200 and 20 Khandis of paddy per month as payment. This was collected from all villager. Moreover fines were imposed on woodcutters and this was deposited in the village fund, used to pay the watchman. Such was the unity of the villagers that even when forest officials offered Rs.45,000 for the bamboos, the villagers flatly refused. The patch of forests at Saraikela is like an Oasis in the midst of the desert that is visible for miles around. The villagers have not only protected their forests from the timber raiders of Raipur, M.P. but also planted 11,000 seedlings on 7 acres.

The success and organised method of forest protection in the Khandapada - Dasapalla and Nayagarh - Ranpur areas is worth narrating. Helped by an organisation called BRUKSHYA 'O' JEEVAR BANDHU, the forest movement in Nayagarh district started as early as 1960's.

It was in the 1970's that a conflict arose when the villagers of Ghanasalia stopped smugglers from looting wood from the Binjharpalli forests. The villagers seized the carts in the nights while forest officials maintained a studied silence. Undoubtedly there was some level of complicity for the next day police arrived and remanded many of the villagers to custody for several days. The result was the gradual denudation of the forests in the next decade. But by the 1980's the villagers had reocuped. This time many villages joined together and protected their forests. The unity and the strength worked well. Collection of leaves, twigs and branches was regulated and soon there was regrowth of trees. In spite by efforts by other villages to cut down the trees and repeated inter and intra village conflicts the trees of the Binjarhapalli forests still stand upright. Similarly with the inspiration of BRUKSHYA 'O' JEEVAR BANDHU 25 villages of Ranpur area, 8 villages of Mahipur block, 20 villages in Jogipalli forests, and 26-28 villages near Itamati area protect their forests. They follow the Thengapalli (stick rotation) or Muthichakla (a palmful of rice) methods. The former requires that each family of the village patrol the forest for one day rotationwise and the latter implies that every family of the village donates a handful of rice to the person who guards the forests. Both the systems have been working with success. Apart from this, village committees look after all matters relating to forests. Penalties and fines are imposed on those who violate the rules. Infringement of rules is also dealt with social pressure, persuasion and sometimes physical force as well.

Another encouraging fallout of such forest protection movements is that, they become contagious. When one set of villages start protecting their forests there is pressure on villages nearby to protect their own forests. Most heartening is the fact that the government recognised the role of Brukshya 'O' Jeevar Bandhu and honoured it with a national award.



Pix : Kundan Singh.

People's forest protection movement is very spontaneous in Orissa : which is the only hope to preserve the ecology and meet the needs of the people.

School children are trying to create awareness for preservation of forests.



Pix : GPC, Bhubaneswar.

COMMUNITY DYNAMICS : Caste, class, political and cultural differences can become an impediment to people's movement. Social tensions escalate on issues related to the forest or any other matter on these lines many a time. The united conservation efforts of the villagers of Dhaumada received a setback when some of its landless wanted to construct houses in the Bagayat tota (mangrove forests).

DEMARCATION OF FORESTS: Lack of demarcation of forests result in conflict in villages, most often after forests have grown. A particular village conserves protects and sees to it that forests regenerate and after that a bigger village around it make claims on the forest. Such cases are widespread.

AREAS OF CONFLICT

The success of the people's movements however does not give any room for complacency for there exist many areas of conflict which constantly undermine all the efforts of the people. Saw mill owners, smugglers and contractors who live in small towns or big villages around forest areas with small villages form power centres and are largely responsible for illegal timber trade, having the support of officials, the police and local politicians. These power centres are a threat to hamlets and villages which try to protect the forest.

GATES : One observes around 50 gates in Rampur area. These are not octroi checkgates or that of the forest department but the local mafia men collecting their hafta, "tax", from wood smugglers.

USER GROUPS : A group of people cut trees to prepare charcoals for village artisans. This phenomenon has been observed at Gania. The demand for charcoal by the brass workers at Kantilo or at Balakati, Bhatimunda etc. is met by them. Alternative fuel must be found for these artisans while those preparing charcoal must be rehabilitated. In spite of all these setbacks people's movements still thrive. Recognising the potential of such movements the government passed a resolution in 1988 that communities must be involved in forest protection. In 1990 it resolved to form Forest Protection Committee (FPC). But although 6000 of them exist on record, many do not function. Government intervention has disturbed the spontaneous movements of the people. With the organisational set up has come tussle for power and bossism that is far from being welcome. However in July 10, 1993 the Government took the right step in recognising the VFPs (now called Bana Surakhyana Samiti) giving them 50% of the total harvest as incentive for protection and conservation of forests. This has gone a long way in giving the right signal to the people and ensuring their rights and privileges over their forests.



Pix : CPSW Documentation Centre.

A group of youth in a cycle march through out Orissa - learning & Educating the people for environment conservation.

FOREST PROTECTION : THE ACM EXPERIENCE

The ***Antyodaya Chetana Mandal*** (ACM) arrived at the most opportune movement to awaken the villagers of Rasgovindapur block from their slumber into a united mass of people concerned about their forests. It all started when 'Sal' felling on a large scale occurred in Rasgovindapur of Mayurbhanj district. It was in 1984 and the ACM stepped in warning people of the dangers of deforestation and mobilising them into village level forest protection committees. By 1985, 12 such committees were formed. Subsequently a Regional Forest Protection Council, the larger body was formed. Meanwhile meetings and rallies both at the village and regional level were held by the ACM with the help of noted environmentalists, government officials and local leaders. At the same time a cycle rally was flagged off for the first time on 15th Aug, 1986 from Rasgovindapur block. This was a new mode of spreading the message of conservation. The ACM also imparted leadership training in forest protection to many of the FPC leaders. The seed shown by the ACM was not in vain. A follow up of activities of villages in Rasgovindapur block is an eye opener to the organisation's success in evoking people's participation in forest protection.

Plantation of Acasia & Eucalyptus was undertaken in the forest of the area by the government that took steps to uproot small Sal trees. The people were enlightened on the idea that Eucalyptus and Acasia do more harm than good to the local environment. Their realisation acted as a driving force so much so that people unitedly protested against the government move and uprooted the Eucalyptus and Acasia plants already planted. The government had to yield to the wishes of the people and abandon the programme altogether thereafter.

In 1986 the united action of villagers of Podapada, Bagsahi and Madhuria to preserve the forest of their area was thwarted by vested interests and an unscrupulous contractor who implicated them in false charges. In course of the events that followed an activist of ACM was beaten up mercilessly by vested interests in the Amarda village, which is a power centre nearby, for carrying on a campaign against degradation of forest.

One day, the villagers of Bagsahi village, were on their usual rounds guarding their local forest, detected a number of villagers of the nearby Bansuli village cutting wood illegally in the forest. They tried to prevent them, the result was that, the voluntary guards were beaten up in retaliation. To add to it, villagers of Bansuli lodged an FIR in the Rashgovindpur Police Station accusing the voluntary guards of Bagsahi village of theft. At last the Regional Forest Protection Council intervened in the matter and sent a memorandum to the District Collector and Superintendent of Police, Mayurbhanj as well as Divisional Forest Officer, Baripada. Subsequently, the culprits were brought to book.

Another incident that speaks volumes about the ACM is the participation and awareness of rural women who amply demonstrated their indomitable will and courage of conviction as well, when women of Raisul village were stealthily taking away wood from the forest. This was detected by some women of the nearby Ambadiha village who tied up the thieves with a string and brought them to the Forester's Office there.

Again on the 14th June, 1993 the forest protection movement of ACM received another serious setback when villagers of Itahari felled Sal trees in the very forest which they had protected themselves. Those who had actually indulged in such vandalism became reluctant to sort out the problem when a remedy was sought by ACM. Even the ex-MLA of the area who happened to be an inhabitant of the village pleaded helplessness in the matter. The matter could not be settled at village level and the Forest Department was informed of it. But then, the forest authorities could not do much. Sadly, the culprits managed to go Scot-free. Despite such setbacks the forest protection movement is gaining momentum day by day in every nook and corner of Rashgovindpur block and the morale of villagers as also activists is very high. The ACM has become a flag bearer in the history of forest protection movement in Orissa.

JOINT FOREST MANAGEMENT : A NEW DEAL

Areas where sizable root stock or scrub type of vegetation is available before protection, the flow of benefits come within a decade. In most cases the committees enforce a system of distribution suitable to all categories of people. They have been very successful in protecting and managing in many cases. Though, the rational behind Govt.'s initiative for 50% of the share to the villagers, is difficult to understand, the JFM is still a most welcome decision. Even, then the people have to continue their struggle for a fairer deal, and protection as well as sustainable management of forests is going to be a most challenging task ahead. JFM has been accepted by Govt. of Orissa (Refer G.O., July 05.1993). Under this scheme the State Forest Deptt. and the villagers of adjacent villages will become equal partners in the task of regeneration and restoration of the degraded forests (Reserved and Protected Forests). Recognition and acceptance of the importance of the role of Vana Sarankhyana Samiti (VSS) is a historical step, though it is yet to be made a law by the government.

Extending Technical support in development of JMP : Prof. A.B.Mishra in an exercise in a village.



ROLE OF NGOs in JFM

NGOs, have been actively involved in the forest protection movement by organising people into village protection committees long before Government started doing so. There are several examples of such efforts all over the state which has motivated and organised tribals into VFCs.

The NGOs work with the people to improve their standard of living through various programmes such as education, health, income supplementation, agriculture etc. More so the NGOs revive the people's faith in their own capabilities and ability to work as a united force. The NGOs also facilitate people's organisation and improvement process. The Government has increasingly started networking with NGOs to implement various programmes.



Pix : Sanjay Khatua.

Forest protection : The socio-cultural & Religious links - a strong point.

More than mobilisation of people, NGOs can play a major role in propagating alternate sources of energy, so as to reduce the pressure on the forest, they can liaise between the people & government till such time that the people can take over the responsibility themselves. Conflict resolution seems to be an important work at the moment. The NGOs can also play an important role in drawing up the Joint Management Plan (JMP) turning attention towards the VSS again. Marketing of harvests will be a challenging task. Otherwise, all efforts will not yield any benefit to people. Here, the role of NGOs seems crucial. It would be useful if the following points are spelt out in detail for a rational and effective forest management and to reduce the social tension.

Delineation of forest area for each village,
Powers of the VSS members.
Conversion of FPCs formed by NGOs into VSSs.

- Role of villages who do not have any forest land of their own and are dependent on forest managed by other villages.
- Arrangements for specific user groups like potters etc. whose fuel demand is very high.

Unless these issues are addressed properly, it cannot facilitate the smooth functioning of the JFM and realize the objective of restoring and regenerating degraded forests.

Peoples' initiatives for protection and management of forests is very significant for sustainable management of forest resources. The government, the forest department, the NGOs and the academicians should join hands with the people to make this movement effective as this is the only way to save the forests.

THE PROPOSED CONSERVATION OF FORESTS AND NATURAL ECOSYSTEMS ACT

- A critical Appraisal

The proposed law is an encouraging one in that it has a considerably enhanced conservation orientation compared to the 1927 Act. However, it needs to recognise that the country's remaining natural forests need protection not only from diversion but also from degradation. All such factors responsible such as conversion to plantations, reduction in tree species, diversity by emphasising and enhancing a few economically important species, commercial logging and other similar forestry activities, excessive biotic pressure due to fuelwood and fodder demands, etc. needs to be controlled by the proposed law. Otherwise the whole purpose of the law will be defeated.

The main criticism that Environmentalists and Activists have against this is the fact that though there has been widespread recognition of the need to make forest conservation and utilisation a participatory activity this has not been taken care of by the proposed law. The declaration, management, and monitoring of not just VFs but also RFs and PFs must involve local communities as equal partners. It is high time that commercial pressures be completely diverted away from natural forest areas, perhaps in a phased manner. The proposed law does not take cognizance of this.

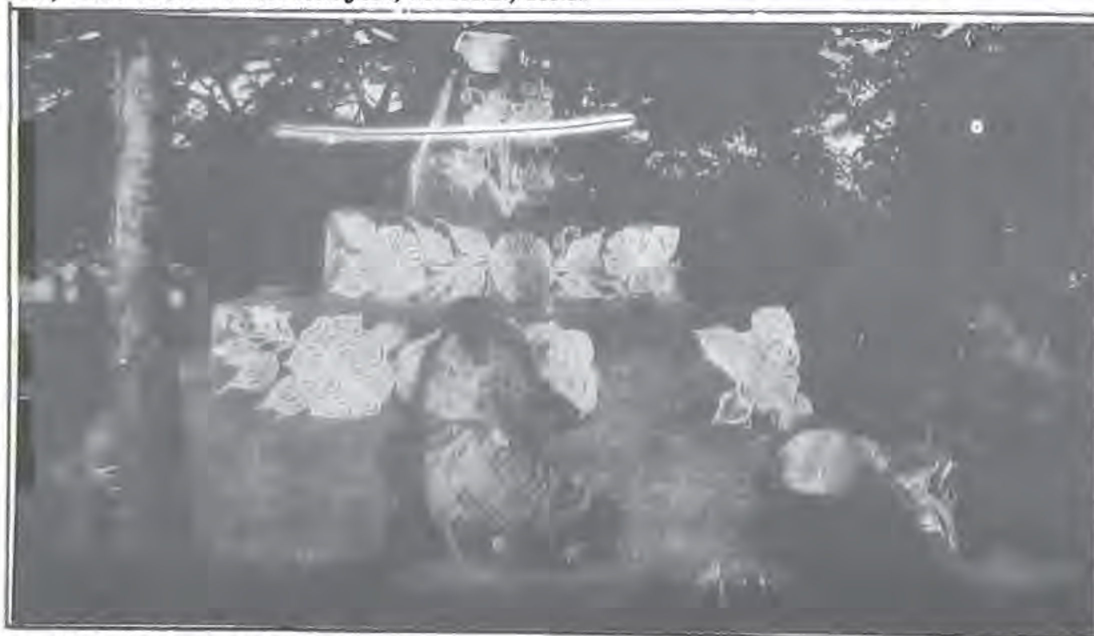
In Orissa, a successful people's movement, the "Green Revolution", took place spontaneously, often promoted by voluntary organisations or sincere forest officials. It is estimated that approximately 10,000 village forest protection committees are functioning (though Govt. estimated this number to be 6000 a few years back) in a potential area of not less than 10,000 sq.kms. of forests. Such initiatives are being promoted in many areas while having an effective spread out impact. Though these people's initiatives are the only hope to protect the forests than the policing role of the state, they suffer from various difficulties (discussed earlier). However, the proposed law instead of legitimising these people's movement to save forests, slightingly overlooks them.

It is true that the rights and responsibilities of communities that manage village forests have been more carefully spelt out. However, the Act will ensure that only very limited areas will be available for possible constitution as village forests. Most crucially, the Act states that village forests cannot be constituted from reserved forests. The Forest Department has kept the best and the majority of the land for itself, with limited people's access to this land, while allowing them to have very little, already degraded land elsewhere.

Also, Section 34(J) allows the State Government to take over village forests, while Section 35 provides for the state's acquisition of sacred groves even if these have been protected by villagers for generations. These provisions will create serious conflicts and will result in frustration of people. It is even apprehended that people might destroy all the forests protected by them.

It is proposed to stop all activities in forest areas on slopes above 30 degrees gradient which will be applicable for shifting cultivation; and all other commercial activities on lesser slopes, the same test of "carrying capacity" which it imposes on other activities, Section 40.AI(b); and subject all cases of large-scale diversion of forests to the requirement of clearance from both Houses of Parliament (as stipulated for regularisation of unauthorised occupation, Section 34(9)). Over 3 lakhs families are engaged in shifting cultivation in Orissa. All our efforts to wean them away from this practice could not succeed (discussed earlier) in spite of provision of suitable alternatives. However, the law now proposes to forcibly dislocate and rehabilitate them, even though it has an equally bad record of rehabilitation. This is going to pose a serious socio-economic, cultural as well as political problem. The concern about the carrying capacity of the land and the need for conservation of forests is definitely needed. But, the proposals need to be carefully examined and such a public law should be openly debated before it is enacted.

Revival of Socio-cultural life can help to preserve the forests. Pix : Sanjay K. Khatua. 2.34 Massive scale Eucalyptus is planted every where which is neither ecologically nor socially useful.



Pix Ghani Zaman for CPSW

Sections 1.12 and 13(d) state that the exercise of rights in reserved forest, such as the collection of fuel, fodder, etc., can be continued subject to the carrying capacity of the land and its overuse will be prevented. And if the land is considered 'already degraded', the Forest Settlement Officer can immediately stop the exercise of rights until he is satisfied that the land has been 'restored to its potential productive capacity'. Again, Section 22(A) provides that all rights can be commuted, i.e. extinguished with a one time payment, if the Gov-

ernment considers this to be necessary for the prevention of 'degradation of the said reserved forest'. Likewise, Section 76(A) reserves with the Central Government the right to make any rules for 'rationalizing rights, privileges and concessions in respect of forest produce from reserved and protected forests'. This rationalization can of course be used to extinguish the rights of the forest dwellers in due course of time.

Under this Act a forest officer can arbitrarily decide that the carrying capacity of a particular patch of forest will not permit the exercise of traditional rights, and thus stop all access to the area in question. In this manner, a spurious concept such as carrying capacity will be used to deny the legitimate and long exercised rights of the people. On the other hand, where people are prepared to mange the forests sustainably, they will not be entitled to do so.

The state can, if it so chooses, exercise a monopoly on any kind of forest produce, on its trade, transit, sale etc. 'whether such forest produce is grown or found on land owned by the State Government or on private land' (Section 40A). Again, individuals cannot open or operate saw mills, but the State Government, if it so wishes, can do so (Section 40D). The State Government thus monopolies the use of forest resources.

The law also state, that every tree-grower is to be registered with the Forest Department and must inform when they plant trees or nurture them and when it is felled or sold. This will create un-necessary interference of Government on Agro-forestry development efforts. Also, the act discriminates or makes no allowance whatsoever for certain groups or communities which have a critical dependence on forest land or forest produce. No provisions has been made for the supply of raw material to artisan families who cannot work with wood, bamboo or forest grass.
The Act attempts to cover not just forests but also all natural ecosystems. The latter would include, as per the definition given in the draft, both terrestrial and aquatic ecosystems: forests, grasslands, wetlands, coral reefs, etc. If indeed it is the intention of the government to conserve and sustainably utilise all such ecosystems, then the provisions will have to be greatly expanded, since the draft mostly deals with forests. Thus, for instance, wetlands require a special treatment, and provisions which are quite different from those dealing with forests (i.g. against draining, pollution, etc., or dealing with sustainable fisheries). Also, the administrative structure currently dealing with wetlands is usually not the Forest Department, so this aspect too will need to be looked into, comments Sri Asis Kothari, a Delhi based Social activist and environmentalist.

The proposed Act gives extraordinary powers to forest officials. All the experiences in the field show that such a situation can only create conflicts between the forest officials and the village communities. As long as the village communities and the forest departments remain enemies, one cannot hope to preserve India's forests which are its national heritage, says Dr.Walter Fernades.

Thus while keeping the conservation orientation of the bill, it is important to give it a people's orientation. People's communities, NGOs and legal experts working with them should be involved in reformulating the law in order to give it such an orientation.

POWER TO THE PEOPLE & SUSTAINING THEIR EFFORTS : THE LAST HOPE

Management of forest resources was earlier a self-regulatory phenomenon and there was no scarcity then. But this self-regulatory system broke down after the invasion of outsiders and the consequent oppression that followed. Timber smugglers, poachers, contractors and sometimes even forest officials have been a party to nefarious activities in the forest. They not only destroyed the forest but also undermined forest protection activities of the villagers by engendering inter and intra community conflicts. Today there exist at least ten thousand forest protection committees in Orissa which is a record number through out the whole country. The challenge thus lies with the present generation of Social Activists, Environmentalists and Forest officials to encourage, support and involve these grassroot organisations to conserve our forest. They should take the cue from the ACM experience in Mayurbhanj district.

Resolving the legal problems, the inter and intra village conflicts can never be handled by the communities alone. This needs the involvement of motivated, oriented and trained forest staff working with the villagers while appreciating their traditional wisdom. Inter and intra village equity is to be assessed properly. Proper mapping and allocation of areas to villages are to be undertaken meticulously. Similarly intra village equity in terms of distribution of products may come to some conflicting ends.
Departmental involvement can resolve the issue considering the power dynamics of the village.

The major threat comes from external environment. Hence, people have to be organised at cluster and range/area levels to encounter such external forces. Government and Social Activists have to promote this kind of mutual cooperation and solidarity. The second important area is technical support in demarcation, development of JMP and marketing of produce, rather than timber. Plantation of NTFP, fruit bearing trees, grass/fodder etc. in village forest lands could be useful which should be undertaken keeping all factors in mind. Another important area would be to develop small scale and cottage industries which can fetch good income and additional employment for the rural sector. Such an integrated approach will help in sustaining people's interests.







NATURAL HERITAGE & ECO-SYSTEMS

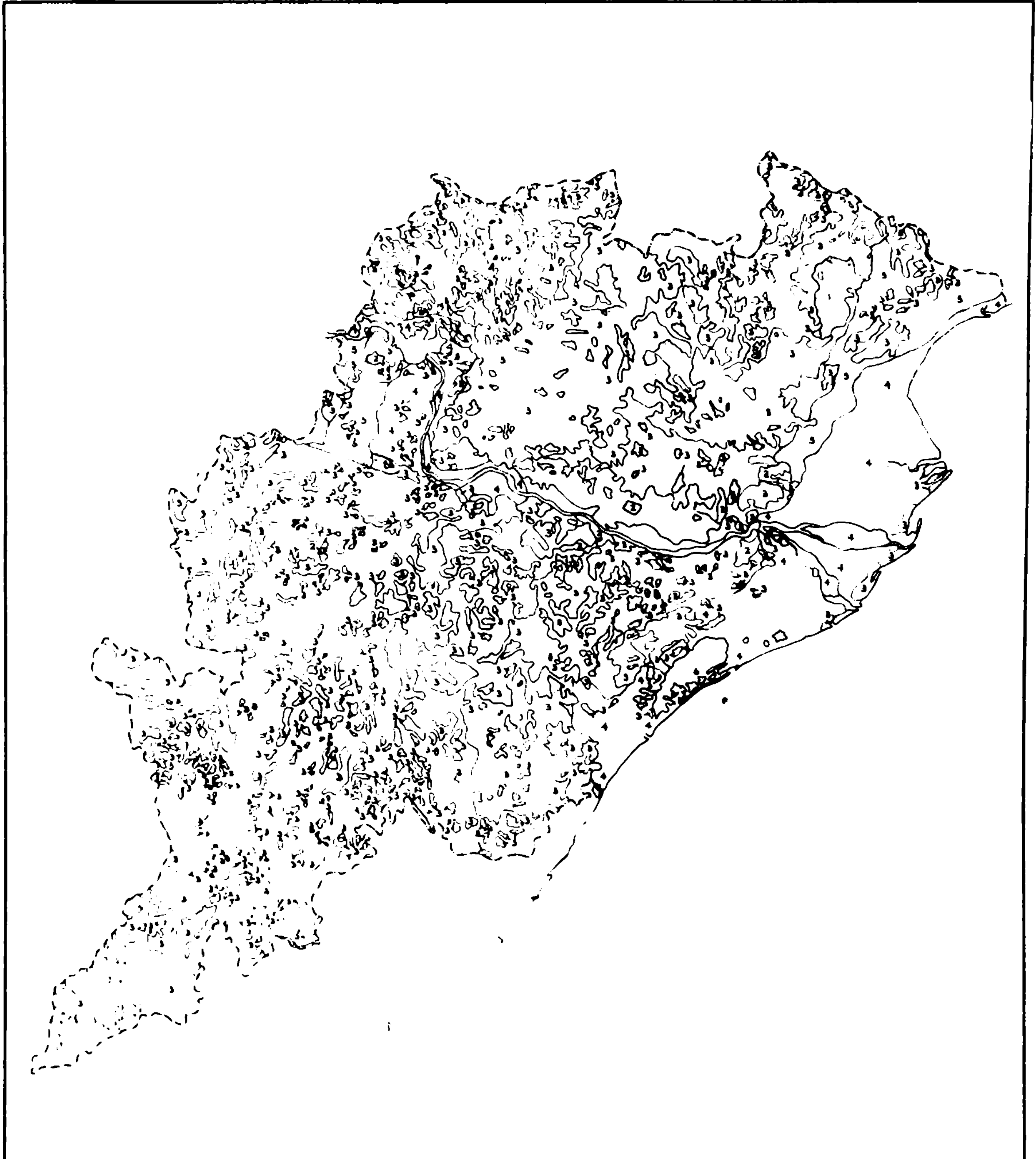
More often than not man conveniently forgets his roots, his past and his heritage in his relentless race for progress. This is even more evident, in the case of Natural Heritage, the flora and fauna around man, that co-exist with him on this planet. It is believed, that the total number of plant and animal species the world has today is nearly 10 million. Out of this man knows only about 2,65,000 plant species and 1 million animal species. Many species in fact, have disappeared, before being known properly. In the past, one species became extinct every 190 years. But, from now to the end of the century, the rate of extinction is one species every three hours.

If the present trend continues it is apprehended, that between 1990-2020, up to 5-15% and between 2020-2050 up to 20% of the species will be extinct. Forests (prime habitat of plant and animal species) are dwindling too. Since the beginning of 18th century, the world has lost about 5 million sq.km. of forests and annually it loses about 21.4 million hectors. In India, out of 75.18 million hectares of forest, 15 lakh hectares are lost annually. Alarmingly, five species of mammals and birds (out of 340 mammal species and 1,200 bird species recorded so far), have become extinct in the recent past, while 146 species (81 mammals, 47 birds, 15 reptiles and 3 amphibians) are listed as endangered under the Wild-Life (Protection) Act 1972.

DWINDLING WILDLIFE

India's Hunting Cheetal, the fastest land animal has become extinct. The Royal Bengal Tiger with a population believed to be nearly 40,000 at the turn of the century, was found to have been reduced to only 1,827 during the National Census in 1972. Black Buck, the most enchanting antelope indigenous to India, found in thousands in plains and savannas about half a century back, now survives only in few pockets, under strict protection. The wild Buffalo, distributed plentily in the thick jungles, is now restricted only to a few habitats, like the Similipal Forests. The Blewith Owl found in Hirakud Dam decades back, is now extinct. The Indian pied Hornbill, the Great Pied Hornbill, the Little spider Hunter & many such birds, are dwindling fast. Similarly, many of the plant species have disappeared and others are dwindling fast. Sal which is the pride of the eastern Ghats, is reducing in density very rapidly.

WILD LIFE, WETLANDS & SANCTUARIES



Source : Forest Atlas of India.

Most of the forests of Peninsular India are relegated to the hills. The plains and flat grounds having been put under plough for centuries, have practically lost all traces of natural vegetation, except some relict patches or a few remnant trees around fields (Legris & Meher Homji 1982). Likewise, water bodies are also shrinking, due to siltation and encroachment. These relict patches are still the natural habitats for a variety of plant and animal species and unless protected, will disappear for all times to come. As in the country, Orissa too faces the prospect of its valuable flora and fauna becoming extinct. Already 42 animal species (22 mammals, 9 birds and 9 reptiles) and a host of plant species have been listed as highly endangered species. It is therefore imperative that immediate measures are taken to protect these habitat and the flora and fauna in them.

There are two broad categories of conservation according to Mahajan (1982). They are (i) National parks, Sanctuaries, Nature Reserves, Tiger or Elephant Reserves, Botanical and Zoological gardens, etc. and (ii) Biosphere Reserves. Measures according to the first category are to conserve selected species in captivity. Here the habitat is managed or manipulated to rear only the desired species. Out of the 250 Sanctuaries in India, 16 are in Orissa and out of 75 National parks 2 are in the State.

The second category, Biosphere Reserves, which are a new UNESCO concept, are designed to conserve the naturalness or wilderness of a place. Here all the species are given equal importance. The ecosystem as a whole is protected and no management is imposed. Nature itself is manager. Biosphere reserves encourage natural regeneration of lost species. It is very encouraging to note that the Simlipal massif has been declared a Biosphere Reserve.

Grassroot level movements like Chipko Andolan, Silent Valley Movement and Gandhamardan Movement have exhibited exemplary courage in preventing anti-conservation developmental activities and saved Nature's wealth for posterity.

Scrapping the Silent Valley Hydro-Electric Project in Kerala, saved the lion-tailed Maccaene and some wild plant species from extinction. Abandoning the bauxite mining by BALCO from Gandhamardan Hills in Orissa, could save indigenous medicinal plants and the water flow in the innumerable streams and nalas.

Like any other state, in Orissa the natural wealth is depleting fast, due to ravages of man. But there are some natural heritage sites still left. These are Chilka, Bhitarkanika, Similipal, Mahendragiri, Gandhamardan etc., which have the potential to restore the ecological balance (including genetic resources), if protected even at this stage.

Topographically Orissa is divided into four distinct Zones (Das 1982) each of which are rich in natural resources. These zones are (1) In the Northern Plateau the Similipal- Meghasan massif (2) In the Central Table Land-Gandhamardan hills, (3) In the Eastern Ghat Region-Mahendragiri-Singaraj-Devagiri hill complex and (4) The Coastal Plains Mangrove Swamps, Chilka Lagoon and Ansupa lake. A description of these heritage is given in the following pages.

THE SIMILIPAL ECO-SYSTEM

The Similipal massif, laid out over 2,750 sq.km area is a unique habitat of mixed tropical forest in the Northern Plateau. It can be called a 'Mirable Visu' for its undulating hills with varied topography, soil, climate, rivers and myriads of flora and fauna.

The Similipal system now suffers from degradation and modifications, due to human ravages. Now that it has been declared a biosphere reserve, there is hope that this natural heritage will be preserved.

Location, Geomorphology & Climate : The system is in the northern boundary of Peninsular India and the southern limit of the Gangetic plain. The Meghasan (1250m) in south Similipal, is the highest among its hills. The hills comprise of Pre-Cambrian rocks belonging to the Similipal Group. Consisting of Archean system of rocks and the Maegnetite, 1,200 million years old (Madhavan and Aswathanarayanan 1955)

Similpal has the typical climate of elevated hilly woodlands in the tropics. It experiences mild summer, with temperatures reaching a maximum of 41°C (May). The rains come in mid-June and continue till September end. The average annual rainfall is 2,500 mm. In Orissa, the highest rainfall in Mayurbhanj District (Das 1989), may be due to the presence of thick forests. During winter the mercury falls to below 5°C (January), when there is snow fall in Meghasan, Upper Barbakamara, Tinadiha and Debathaliarea.

The humidity is generally high, due to thick vegetation. Thunderstorms and dust are usual in May-June. The Similipal system is oval in shape and the longer axis lies in the North-South direction (Nath 1985). Therefore the monsoon clouds are obstructed, from passing beyond to the Himalayas. This causes good rains in the area. **The Similipal system influences the climatic regime of Orissa, West Bengal, Madhya Pradesh and Bihar (Sahu 1986), acting as the water tower of Orissa.**

Watersheds: Budhabalanga, Gangahara, Sono, East Deo, Sanjo, Palpala, Khairi, Bandhan, West Deo and Salandi are the principal river streams. Besides, there are a number of small streams and springs. Barehipani (400m) and Joranda (153m) are the two prominent water falls.

Tourist Importance : The varied topography, water falls, green vegetation, scenic beauty, cool and salubrious climate, are attractions for tourists. Tourist resorts are there at Gudgudia, Joranda, Barehipani, Chahala, Upper Barhakamara, Lulung and Jenabil.

Forest & Flora : Four types of forests are seen in the Similipal system. They are (1) Northern semi-evergreen forests confined to the upper reaches of deep valleys (2) Northern moist deciduous forests, extending all over Similipal, except the eastern portion and plain Sal forests. (3) Dry deciduous hill forests, confined to the steep eastern and southern faces of Similpal Hills and dry Sal forests, and (4) high level Sal forests above 900 meters (m.s.1), grass lands and Savanna (Kanungo 1985 a,b)

The Similipal-Meghasan Complex, is the natural ecosystem, representing the ancient Gondwana flora and fauna. Some of its plant species, are common to Australia-Africa-Peninsular India (ancient Gondwana land (Kachroo 1980).

The forest is said to contain more than 1,300 flowering plants, out of a total of 3,000 species found in the State (Panigarhi 1985, Saxsena & Brambam 1983,1988,1989). About 200 medicinal plants are listed in Susruta Samhita, the Ayurvedic classic of the Dhanuantari school (Panigrahi, 1985). Sal *(Shorea robusta)* exists in high proportion. Among other associates simuli*(Bombax*

Similipal Tiger.



Pix : Eastern Press Agency

ceiba), Arjuna *(Terminalia arjuna)* Asana*(T.alata)*, Jamu *(Syzyqium cumimi)*, Champa *(Michelia champaka)*, Kendu *(Diospyros melanoxylon)*, Piasal *(Pterocarpus marsupium)*, Mahua *(Madhuca latifolia)* are some of the valuable species. The forest is also enriched with tapestries of giant lianas, club mosses, shrubs, grasses and chandeliers of various coloured orchids.

The Similipal forest is a treasure house of terrestrial and epiphytic orchids (Misra 1980, 1982, 1985, 1988). These are a class of climate sensitive species, which disappear with modifications in the habitat. Out of 126 orchids species found in the state, 90 are in the Similipal system (this includes 20 Himalayan and 8 Nilgiri species of South India)

Many of the species are facing a threat, due to modifications of the ecosystem and have entered the IUCN Red Data book as 'Vulnerable', 'Threatened', 'Endangered', 'Rare', and 'Indeterminate'. *Aspidopterys tomentosa var hutchinsonii* (Haines) *srivastave*, a slender twinner categorized as 'rare', was endemic to Mayurbhanj Hills. It was last collected in 1937. *Toona ciliata* is another 'rare' plant in the forest. Among Orchids *Dendrobium cathcortii Hook f, Goodyera procera* (Kar. Gawler) *Hook, Habenaria crassifolia A.Rich, Liparis teretifolia Gaudich* are some of the species of Similipal Forest listed in IUCN Data base for Orissa (Anonymous 1987 a). The other species of orchids listed in the Red Data book are *Eria Meghasaniensis, Liparis resupinate Ridl. , Bulbophyllum panigrahianum, Tainia hookeriana, Goodyera hispida, G.fumata Thv. Acampe rigida, Acanthephippium sylhetense* etc.

Fauna : Apart from tigers, The Similipal reserve boasts of 134 tuskers, 309 female elephant, and 64 baby elephants, 428 wild dogs, 305 bears, 4500 kutras, 3500 deer, 950 busks, 1300 gurand si, 9000 sambar, 10500 wildboars, 8000 monkeys of different species and rare birds like the "East Himalayan Long-Tailed minivel", Sichimter bubbler, Jerdon cloropris, Red Falcon and 230 kinds of other avifauna. Similipal is known for Hill mynah, the lovely mimic bird which once occupied the prime position in the world pet market. There are varieties of snakes and other terrestrial and aquatic reptiles. In the deep waters of the rivers, muggar (the marsh crocodile) and Terrapin are found. All the hill streams and rivers are rich with Mahaseers.

Tribes : The bulk of ethnic strata in the Similipal area are tribes, like the Perenga, Kharia, Mankidia, Saura. A survey report indicated, that there are only 314 Hill Kharia families, with a total population of 1,259 and 37 Mankidia families, with a total population of 133. Santal, Bhunuja, Ho, Bathudi, Gond, Paudi Bhuiyan, Mahilis, Sounti are the other tribes. The total population of different tribes in Similipal, is about 8,000 in about 65 villages.

The forest has been the chief source of major and minor forest products, for subsistence of the forest dwellers. Besides, the tribes have links with the forest, for their socio-cultural life. In Similipal Salai Puja (worship of Sal tree) and many other rituals, are performed to worship the forest. Professional trades associated with day to day life of the tribal people.

1. Sericulture-Indian sericulture industry dates back to thousands of years. The illiterate tribal man inside the forest is its rearer. A distinct forest belt spreading over the Central Plateau of India, covering the states of Bihar, Orissa, Madhya Pradesh, Karnataka, Maharashtra, West Bengal and Assam is the home of tassar.

The rearing of silk worms, sericulture, is an important economic activity for the tribals with tassar at the core. Out of 40 eco-races there are 4 in Orissa and out of these, 4 races, Goda Modal's, the best, is now restricted to the high altitude of Similipal forest.

2. Honey collection fetches a livelihood for the tribals. There are varieties of honey-bees in Similipal. Out of these Baghua is the best. Although this type of bee is extremely furious and aggressive, yet because of the quality and quantity it yields, the tribals prefer to collect honey from this source.

Dears in Similipal.



Pix : OES, Bhubaneswar.

3. The making of rope from Sabai grass, is a prosperous traditional cottage industry. In the foot hills of Similipal and the whole of Mayurbhanj District, most of the tribes remain engaged in this trade, with all members of the family working throughout the year.

4. The tribes also collect timber for household work and agricultural implements, fire wood, sal seeds, resin, gum, tubers, roots, including arrowroot, leaves (Kendu leaf for bidi sal and siali leaves for leaf cup and leaf plate) and many other major and minor forest products.

Activities Contributing to Forest Degradation : Unscientific management of forests, unplanned grazing, forest fires, shift cultivation, clandestine tree felling, wildlife poaching (for skin, tusk), Akhanda Shikar (annual mass hunting of wild animals) and bird catching, are some of the traditional destructive forces, affecting the forest and wildlife in Similipal.

From British times the forests were a rich source of timber for sal sleepers, defence equipments etc. In a move to provide land to the landless for agriculture and human settlements, large areas of forest were cleared. It may be mentioned here, that during 1972-74 alone about 6,000 hectors of forest land in the South-Western part were cleared for human habitation. More and more encroachment of the forest are made, for agriculture and human settlement.

In some areas, exotic species like Eucalyptus, Acacia, Cassia, Pine, etc. are planted, either on degraded land or by replacement of indigenous plants like Sal. These exotic plants are no substitute to Sal, a hardy specious with tremendous regenerative or cropping ability, Sal is the climax community in Similipal ecosystem. Similarly many other indigenous species are being replaced.

There are about 200 villages in the periphery and 65 inside the sanctuary area and another 850 villages around Similipal forest, within a 5 Kms radius. In addition to pressure of the people on the forest products, the large number of domestic animals in these villages, put a heavy grazing and trampling pressure, on the forest.

The human population inside the core area of Similipal, which comes under the National Park and Tiger Reserve, was thought to be a hindrance. Hence it was proposed to shift nine villages (about 250 house holds) from this area in the first phase and some more villages from the buffer area in the second phase. The majority of them are Santhals. This caused discontentment among them. Considering that they are sons of the soil and have been living in harmony with Nature through ages.

However, migration of indigenous population from their ancestral lands, should be made out of choice and not by imposition, according to Ramakrishnan (1987), a noted ecologist. He suggests creation of conditions to attract outward migration, by proper awareness build up, education and eco-development projects, including forest-based traditional cottage industries in the periphery.



Pix : Sanjay K. Khatua.

Traditional Snake Charmers,

Mining threats Similipal Eco-system.



Pix : Manoj K. Pradhan.

of genetic diversity. **It is imperative that the Similipal biosphere be protected with sincerity and singlemindedness of purpose.**

At Ramatirtha (Joshipur) in the foot hills of Similipal Forest a Mugger Conservation Centre was established in 1979. In 1988, with a view to protect orchids in their natural habitat, the SFDC set up an orchidarium at Gadgudia.

In the recent past (September 1990) at Sabalapahada at the foot hills near Khunta and Badaghati Pahada near Meghasan (about 15 km away) towards Udala, cracks have appeared in the land and profuse land slide erosion took place (Padhi 1991). Geologists observed, that the rocks of the area are fine grained, acid volcanic type. The thin soil cover allows only small bushes to grow. The boulders of basic rocks are strewn all over the slope.

One of the main causes may be lack of adequate tree cover, Such landslides in remote areas are of no serious consequences, but in populated areas, certain protection measures may be necessary.

Orissa lies within the same range of latitude, as the Sahara or Arabian Desert. If any damage is done to Similipal Meghasan range, it is bound to have its affect on the whole of the Eastern-Ghats, Northern Plateau, and North-Eastern Hills range. It may lead to Saharan and Thar Desert conditions (Fig, Patro 1988, Sahu 1985, Patnaik 1990).

The ravages of man have already destroyed the forest to a miserable extent. The time has come to restore this rare forest heritage, to its earlier glory, before reaching a point of no return.

Protection & Conservation Measures : Out of the total area of 2.750 sq.Km. 303 sq.km, was set apart for a Tiger Project established in 1973. The balance area of 2,447 sq.Km was brought under a government sponsored organisation in 1979, called Similipal Forest Development Corporation (SFDC), with World Bank assistance. Although the Corporation kept provision for eco-conservation, it allowed commercial exploitation. It constructed motorable roads, felled trees, and allowed free movement of vehicles.

The Tiger Project area of 303 sq.km. was declared as a National Park in 1980, and extended to 845.70 sq.km. in 1986. On the recommendations of the House Committee on 'Similipal Forest Development', the State Govt. had put a moratorium in 1982, on tree felling . In 1988 a high level committee recommended keeping the whole of Similipal Forest (2,750 sq.km.), under a single authority, called Similipal Development Authority.

Table - 1 : Tiger Population at Similipal Park

Year	Number	Year	Number
1972	17	1979	65
1975	30	1984	81
1976	46	1986	89
1977	56	1989	93
1990	94		

The success of the Tiger project gives a lot of encouragement, but no room for complacency. A balance between human life and wildlife in the buffer zone has to be struck. Moreover, the proliferation of forests weeds and pests must be controlled. Development projects like the proposed project at Barcipani must be planned with care and if necessary, must be completely halted. The project may submerge around 709 hectors of forest land, leading to the destruction of wildlife

National Environment Awareness Campaign.



Pix : OES, Bhubaneswar.

GANDHAMARDAN HILLS

The Gandhamardan Hills complex in Western Orissa, has rich genetic flora, including medicinal plants and is a place of mythological and religious importance. The economy of the people of the area is forest-based, with the system a constant source of support for their subsistence.

Location, Geomorphology & Climate : The Gandhamardan Hills complex is bound by Bolangir on the North-Western side, Sambalpur (Borasambar area of Padmapur sub-division) on the Southern side and Kalahandi on South-Western side. Known as a part of ancient Gondawana land (Sinha 1971) and now in the central Table land of Orissa it spreads over 300 sq.km area, having a cluster of hills, with altitudes varying between 600 to 1,005 metres. It also forms part of Eastern Ghats that run from Nilgiris of Western Ghat up to Mahanadi Valley.

The hills are composed of archaic metamorphic rock types called Khondalites to high level Laterite. The Khondalites are composed of essentially Feldspar, Garnet, Sillemanite, a little amount of Graphite and other-elements. In the geological past through erosion and weathering, the Khondalites have become porous, leading to a cavernous (sponge) profile at the top.

Out of the 2,484.21 million tonnes in the country the Gandhamardan system alone, contains about 230 million tonnes of commercial grade Bauxite, which is the second largest single deposit in Asia. It was the attempt to exploit these deposits by the Bharat aluminum company, that was successfully averted by a grassroot level ecological movement which drew world-wide attention. Mica and other minerals are also available in the rocks.

The Gandhamardan range enjoys a tropical climate and falls in the rainshadow zone of high Eastern Ghat on NW- SW monsoon track. The rain fall is erratic, but the mean annual rainfall of the locality lies in the range of 1250-2200 mm. The summer temperature shoots up to a maximum of 36°C, which may fall down to 12°C during winter. Though the climate is generally dry, the humidity is relatively more, probably due to vegetation cover and rich watershed areas.

Watersheds : The Gandhamardan Hills have more than 800 springs and streams, including 17 large streams. Notable among them are Khandi jharan, Nrusinghanath Jharan, Brahminijhar, Chaldhar, Guptadhar, Durgeijharan etc. The streams flow into Suktel and Ong, the tributaries of the river Mahanadi. There is therefore, ample scope for water harvesting structures, to divert water for irrigation purposes.

Historical & Cultural Importance : Gandhamardhan is of historical and cultural importance to the people of India. Ramayana records that Hanuman procured the Visalyakarani-herb *(Tridax)* for the unconscious Laxama from these hills. It was a resort for the Buddhist monks who meditated here far away from the maddening crowd, planted trees from their countries and even established an University which they called "Parimalagiri Mahavira". Two 11th century shrines of Nrusinghanath and Harishankar, situated at the foot hills of Gandhamardhan make it an important pilgrimage centre for Hindus. A stream running by the side of the shrines, called "Haranapapa" ("Washing away sines") is believed to be sacred.

Flora : Broadly, the vegetation of Gandhamardan can be categorised as semievergeen, at the foot hills (about 30m); and Dry deciduous, towards the higher elevations (about300m). Besides, there are bamboo formations, scrubs and grasslands. The hill top is devoid of tree vegetation and is covered by grassland. The forest is said to harbour about 2,700 plant species, including more than 450 species of angiosperms.

The semi-evergreen forest is composed of tall deciduous trees, which form the upper canopy. This type of forest is seen in the valleys and along the course of streams ascending upto high altitudes. Mango, (local name amba), Mandada Kendu, Kumbi, Kelikadamba, Rau, Limbru, Karanja, Arjuna, etc form the first members of top storey. The second storey consist of Chauladhua, *Ardisia Solanacea, Femingia stricta, Actinodaplia angustifolia* (baghuari) *Antidesma ghaesembille* etc. There are also a number of shrubs, herbs and climbers.

The dry deciduous vegetation constitutes the major portion of the forest coverage. Sal is the principal species here. The other species are Piasal or (Bija), Mahul, Dhura, Asana, Harida, *T. tomentosa* Gahaja, Bahada, Bheru, Kusum, Kendu, and Palasa. Among shrubs in this forest Helicteres isora (Modimodica), *Holarrhena antidysenterica* (Korai), *Phyllodium pulchellum, desmodium heterocarpon* (salaparni), *Flemingia chappur* (Chapper), *Themeda* species etc are the few important ones. Besides, there are many other herbs, grasses and climbers.



Pix : Sanjay K. Khatua

Various species have rich medicinal value.

Upto 700m elevation *dendrocalamus strictus* (bamboo, or baunsa) grows well. The high altitude areas consist of grassy mountain, meadows interspersed with large number of trees. *Cymbopogon martinil* (palma rosa grass) are plentily found in association with *heteropogon contotus Chrysopogon lanceofolious, Themeda sps. Capillipedium assamile, Microstegium* ciliatum etc.

Fauna : Many of the animal species located here, find their place in IUCN Red Data Book. Decades back, the *panthera tigris* (tiger) Panther, (Kalarapatria bagha) and Bison etc. were abundant, but now they have started dwindling. Among other animals are varieties of monkeys, wild cat, Bear, common Indian sloth bear Mongoose, wild dog, jackal, hyena, fox, Porcupine, spotted deer, Barking deer, Antelopes, Black buck, Sambar.

There are a wide variety of birds like wild fowl, red jungle fowl Peacock, Hill mynah, Vultures, Koel, Common mynah, Serpent Eagle, Shikra, Disra, Hawk, Sparrow, Teregrina, Falcon, Great Pied Hornbill, Large Indian Parakeet, Eagle, Duke, King fisher, Spotted Dove, etc. Among reptiles are a few monitor lizards, Cobra, Viper, Banded Krait, Python, Rat snake. In the streams there are a wide choice of fishes.

Tribes : There are many tribes out of which Gond, Binjhal, Sahara and Khondh constitute about 60 percent of the population.

Gandhamardan Forest Ecosystem and People's subsistence : The hill complex being a rich repository of natural resources, is closely related to the life and economy of various ethnic groups living in and around it for long. People collect timber wood, fire wood, wood for agricultural implements and house building, leaves, roots, tubers, fruits, honey, mohua flowers, Kusum, tamarind etc. Agricultural and vegetable crops are prosperous in the area, due to the high level of the water table and perennial flow of water in streams.

There is no migration of labourers from this area. However the poor tribal and rural farmers are not free from exploitation by traders. The population for Gandhamardan area (in a radius of 10 km) was about 25,000 (1981 census). Majority of them depend on forest products as they do not posses land. About 30% of the people are landless, 2% own more than 10 acres land each, 3% posses 3 to 5 acres land, 40% small farmers with 2.5 acres land and 25% marginal farmers with less than 2 acres land, according to a survey conducted by Pradhan (1987). **Though the hills and forests have no human habitation, about one lakh people living around the hills, and in the plains, directly or indirectly, depend on forest products.**

A patch of forests protected by villagers.



Pix : Kundan Singh.

Development of herbal garden : Due to presence of numerous medicinal plants on both sides of the hill, two Ayurvedic Colleges have been established here to promote research and study on medicinal plants. The area has tremendous potential for ethnobotanical study, as the local people are well versed in medicinal properties of plants around them. From time to time suggestions are being made to rehabilitate the valuable medicinal and rare plants of the Gandharmardan hill system.



Pix : Anil Mishra, EPA, Bhubaneswar.

The tribals and local people raising their voice against mining operation of BALCO in Ghandharmardan

MAHENDRAGIRI HILLS

Mahendragiri in Ganjam District of Orissa, is one of the oldest hill forest ecosystems in the country. It is said to be one of the seven kulagiris (principal mountains) in India, regarded as the Himalayas of the Eastern Ghats.

The system is a rare amalgam of genetic species, aboriginal tribes, archaeological and historical monuments. Floristically, Mahendragiri Forest represents the transitional area, where the northern and southern elements are present in the ratio of 1:1.5 (Bramha & Saxsena 1991); hence an unique ecological niche of genetic diversities. However, exploratory study of the flora is inadequate. **The system suffers from severe degradation, in terms of loss of tree cover, genetic flora, fauna, soil erosion, etc.**

A map of Ganjam district published during the British Raj proves that the area was then full of forests. But in the subsequent map released by the government of India in 1974-75, there was hardly any trace of forest in the area except for a few patches. According to the local people, a major chunk of forest has been denuded due to high voltage K.V. lines, leasing out of bamboo plants, indiscriminate tree felling by private contractors and government corporation and resettlement of Tibetan refugees. Unscientific land use and lack of proper attention has led to ravages. Immediate protection and rehabilitation measures are warranted, for the ecosystem to be restored, to its earlier status.

Location, Geomorphology & Climate : The Mahendragiri system in Ganjam District of Orissa, is situated on the northern extreme of the Eastern Ghats, it touches Andhra Pradesh in the south. The system is studded with many small and big hills, of which Singaraj (1516m), Mahendragiri (1501m) and Devagiri (1382m) are the tallest ones. Mahendragiri spreads over 17,000 sq acres area between 18°.54' N latitude and 84°.24' E longitude.

In its geological formation, the system is composed of Gneisses, Charnochites and Khondalites. These are believed to have been formed in the early pre-Cambrian era. Bell metal, Iron, Mica, Hard Granite, Lime Stone, Chalk and Red-earth, ave some of the main minerals in the system.

The average annual rainfall in the hills is 1552 mm, with September receiving the highest rainfall and the South-West monsoons contributing nearly 65 percent of the total. The temperature is temperate in summer and cool in autumn. In winter, during December-January, severe cold and sometimes snowfall is experienced in the deep valleys.

Habenaria plantaginea (Lindi) is one of the rarest flora in Mahendragiri.



Pix : S.Mishra, OES, Bhubaneswar.

The climate on the hill top is very peculiar. Every day one experiences all the six seasons. In general, a salubrious and pleasant climate is experienced in and around the hills.

Because of its location and certain distinctive features, the forest terrain is strategically important, influencing the ecology and climate of the Eastern Ghats and Southern part of the Country.

Watersheds : There are numerous small, medium and big perennial and rainfed streams, ultimately emptying their waters into the Bay of Bengal. The Mahendratanaya is the chief river, which rises at the peak and flows down into two streams, one southwards into the Parlakhemundi area to join Vansadhara river and the other eastward, through Mandasa, ultimately entering the Bay of Bengal, near Barua in Andhra Pradesh.



Pix : Dr.S.N.Patro.

Symbolic relationship between natural heritage and cultural heritage. : Mahendragiri temple.

MAHENDRAGIRI : RELIVING THE PAST

The very name Mahendragiri evokes innumerable tales and legends as well as scenes from the past. To do away with this rich hill forest ecosystem would be therefore to deny the past and cut off one's own roots.

Viewing this hill, one can imagine Hanuman taking off with a gigantic leap in his onward journey to Lanka or enter into a meditatoure frame of mind with Parsuram who is believed to have sat here for 12 years in meditation or even translate oneself to Rama who in this very place received his powers from Vishnu. No wonder then, that Mahendragiri is mentioned in numerous sacred scripture like the Ramayana, Mahabharata and all the Puranas. To make this

tale more than a figment of imagination, one can visit the temples dedicated to the heroes and heroines of Indian epics - Kunti, Bhima, Yudhisthir, Vishnu, Arjuna, Nakula, Sahadev etc. Most of these temples are of the 5th to the 12th century AD and therefore archaeologically important. Structurally, the Yudhisthir temple may be compared to the Satrughneswar group of temples at Bhubaneswar. Moreover, the Bhima temple is one of the earliest specimens of temple architecture in Orissa, belonging to the Gupta age. Apart from the temples there are caves with sivalingams enshrined therein. But even more historically significant are the stone inscriptions in Devangiri, Tamil and Telgu. Two are found at the entrance to the Gokarneswar temple (1123 AD), a third at the lintel of the door of the Yudhisthir temple (1015-22 AD) and a fourth near the Kunti temple. Mahendragiri is therefore archaeologically and religiously important. So much so that it became a Saivite centre and even today it is regarded as sacred place where Mahasivaratri and Pitrushradha are performed with great pomp and splendour.

A peep into history also reveals how strategically involved Mahendragiri had been in the past. Samudra Gupta rested here during his Southern Expedition (Allahabad Pillar), the Ganga Emperor Chodaganga Dev, used Mahendragiri as his stronghold and had 99,000 war elephants. Infact even today the Parlakhemundi dynasty is known as Gajapati (King of Elephants). So popularly known was Mahendragiri during ancient times that even Pliny, Ptolemy among other foreigners mention it in their books. Huien Tsang of course observes that it was a multilingual place occupied by both Aryans and Dravidians. Though to today's generation, Mahendragiri is just another hill range, it is in truth, a living monument, a natural museum in itself.

Flora : According to classification of forest types of India, by Champion & Seth (1968), the forests of Mahendragiri fall mainly under (a) Tropical Moist Deciduous and (b) Tropical Dry deciduous types. However, the vegetation of Mahendragiri system could be classified broadly into four types-Sal forest, Mixed forests, Grass lands & Scrubs.

Sal occurs throughout the forest. But its size varies with variation of altitude and edaphic conditions. At the basal region it is stout and may attain 18-30 m height, whereas at the hill top, it becomes stunted and reaches upto 10 m height only.

Sal forests which occur in continuation with the semievergreen type close to the moist valleys, are classified as tropical moist deciduous forests. Wherever the conditions are hot and dry the Sal is of poor quality and the forests may be classified as tropical dry deciduous.

Moist valleys and the steeper drier slopes and other places at lower elevations where drier conditions prevail, are occupied by mixed forests. Here, Sal usually disappears, while many of its associates dominate the vegetation.

Over the hill top, due to high altitudes and elsewhere, due to anthropogenic and biotic interference, there are scrub forests and grasslands. Besides valuable tree species, hardy scrub species are found in such areas. some of them are kantei koli, *flacourtia sepiana, Pavetta indica, Toddalia asiatica, Capparies species, Gymnosporia emerginata, Carissa spinorum, ichnocarpus frutescence* etc. The important grass found are *Themeda triandra, T. quadrivalvis, Cymbopogon flexuosis, Chrysopogon assimilis* etc. The non-grass species are *Crotalaria sps, Viola betomicifolia, Tephosia roxburghiana* etc.

Besides, there are many species of climbers, shrubs, herbs, grasses, ferns etc. in all the types of forests. Gymnosperm is represented by 2 indigenous species and the forest is full of innumerable medicinal plants. **The flora of Mahendragiri is unique in that it represents a combination of Himalayan as well as South Indian species.**

The characteristic Himalayan species are *Maoutia puya, Viola serpens, V.betonicifolia, Clematis roylei, Rhamnus nopolenis, Anotis Calycina, Ajuoa macrosperma, Thalictrum foliolosum, Rubus ellipticus, Rubia cordifolia, Sarcococca trinervia, Zenthoxylum armatum, Ophiopogon intermedius* etc. (Bramham & Saxena 1991).

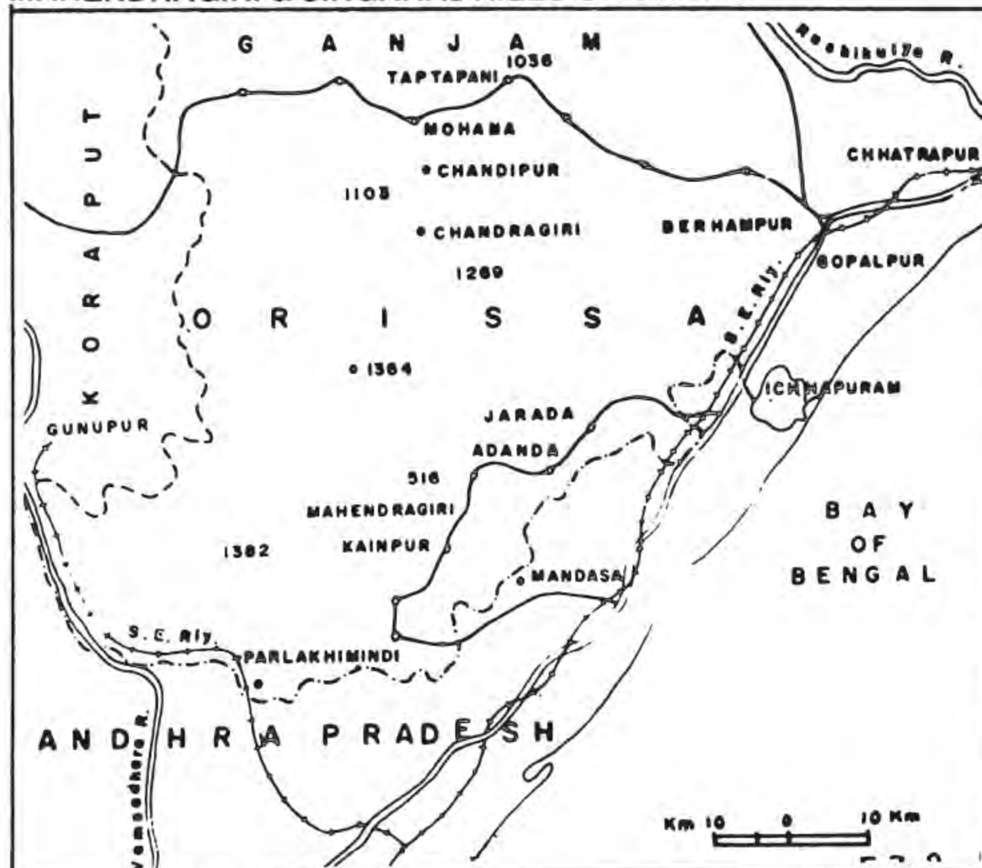
The important South Indian species are *Tephrosia roxburghiana, Sida rhombifolia sppretusa, Toddalia asiatica var. Obtusifolia, sophora interrupta, Wendlanda gamble, Pavetta brevifolia, Anaphalis lawiri, Senecia candicans, Diospyros candollenuna, Peperomia portulacoides, Neolitsea zeylanica Molineria finlaysoniana, Clausena heptaphylla* etc. (Bramhan & Saxena 1991).

The Assamese species are *syzygium cuneatum, Linociera macrophylla, Litsetacta*, etc. and the Burmese and Javan species are *Psychotria fulva Ham, Ophiorhiza terichocarpos Bl.*, etc (L.CO).

Bramham & Saxena (1991) have identified 642 angiospermic species out of which 17 are new records to Mahendragiri. They are *Aganosma cymosa, Cyanotis vaga, Justicia glabra, Maoutia puya, polystachya flavescens, Sida rhombifolia, Sophera interrupta, syzygium cuneatum, pittosporum nepaulense, Eulalia quadrinervis, Jansenella qrilfihiana, Neanotis quadrilocularis, Ophiorrhiza trichocarpos, Paspalum compactum, P.conjugatum, plectranthus nilochericus and Psychotria fulva.*

Orchids are a class of plants with most beautiful flowers that the nature has ever created. The orchid flora is an indicator of

ORCHIDACEOUS FLORA OF THE MAHENDRAGIRI & SINGARAJ HILLS OF ORISSA



Source : Sarat Mishra, OES, Publication

the type of forest and the climate. The Mahendragiri system is not very explored botanically. Gamble (1892) and Kapoor (1964) Isher (1928) refer to only two species of orchids found in Mahendragiri. Therefore the Orchidaceae family did not figure in the list of first ten dominant families of the Mahendragiri system. Although later workers did find orchids it was Misra (1983) who did a good study. According to him the Singaraj mountain Hills (1506m) which was not botanically explored earlier should be considered as a single botanical unit together with Mahendragiri. Mahendragiri Singaraj system, *Habenaria arnigrahiana* S. Misra formed a new taxon (Misra 1981)*Polystachya flavescens* (bl) J.J Sen is a western peninsular species, *Bulpophyllum unbellatum Lind* 1, and *B.polyrhizum* are Himalayan species (Misra 1980) in the system. During a recent survey conducted by Misra during a program under NEAC 1991 conducted by the Orissa Environmental society two more orchids *castrochitus acaulis* (lindle) KZE and *Eria pubescense* (Hook) *steudwel* collected the former.

Fauna : Mahendragiri was inaccessible to man but a hospitable habitat for wildlife. The ravages of man have caused a decrease in faunal species of which some have permanently become extinct from the area. Leopard, Royal Bengal Tiger, Hyena, Elephant, Wild Boar Wolf, Spotted Deer, Porcupine, Musk Rat, Wild squirrel, Bear, etc. are found here (Panda 1991). Among reptiles there are Python, Garden Lizard, Chameleon, varieties of snakes and pangolin. A variety of birds including peacock are also seen. The Wild animals like tiger have shrunk in number, but the elephant population is still sizable.

Tribes : Mahendragiri is home to many tribes including the oldest aboriginal tribe Saura, Langia-Saura, Khond, Pulian, Lodha, Dora, Godaba and Jatagu are some of the other tribes in the hills. **The Mahendragiri Forest system is in a very bad shape ecologically. Its vegetation cover has become very thin. However streams, banks and valleys towards the lower regions still have patches of dense forest. Tree felling, unplanned land use and acute shift cultivation, wildlife poaching, etc., here are the traditional forces of degradation.**

The manifestations of the decadence of the ecosystem are loss of tree cover, soil erosion, drying up of springs, depletion of wild animal population, etc. On the whole the ecosystem is fast losing its wilderness and naturalness. Sal, the principal species of the forest is receding fast. According to Legris and Meher-Homji(1982) the viability of Sal seeds is very short (about 10 days only). Therefore the species is eliminated from the region where rainfall does not coincide with the viability period of its seeds. The other cause of disappearance of Sal, is its selective preference by man, due to valuable use of all parts. The third cause may be its clearance for shift farming. Vigorous coppicing and regeneration ability also could not help this valuable species to thrive due to these three reasons.

Protection & Conservation Measures : The Mahendragiri range of hills which comes under Parlakhemundi Division and occupies a total area of 4,551 sq.km out of which 4,359 sq.km. is occupied by forests. This includes 446.3 sq. km. only as reserved forests. Plantation has been done in about 8,000 hectors of land. The old pure plantation of Red sander *(pterocarpus santallnus)* done in Paralakhemundi area has been established. Modern conservation acts like Sanctuary, National Park, Elephant Reserve, Tiger Reserve, Biosphere Reserve have not been effected in the Mahendragiri-Singaraj-Devagiri system. **Some of the ecological monuments in the system are probably protected as national monuments, only for namesake and no appreciable work has been done to protect or renovate them.** However, recently some NGOs like 'Orissa Environmental Society' 'Sammana' and others have launched peoples movements, to create mass awareness for protection and conservation of the ecosystem.

Mahendragiri Adima Adhivasi Mahasava, is the tribal organisation of the area which is consistently carrying out campaign work and forest protection in that area. This Mahasabha, an apex body of tribals of 42 villages, launched a grand padayatra on 12 March, '91 to highlight the environmental issues of the area. The padayatra which was completed on 10th April, 1992, covered 500 kms and 250 villages. More than 300 tribals from Kandha and Saura communities participated in the march.

Conclusion : Certain measures should be taken, to rehabilitate the ecosystem, archaeological wealth and economic condition of the tribes in and around Mahendragiri system:

1) A thorough survey of the flora and fauna should be done and 'rare 'endangered', 'threatened', vulnerable' species identified, to be listed in the IUCN Red Data Book

2) Appropriate measures should be taken immediately to protect and conserve the wildlife, by declaring it as either Sanctuary, National Park, Elephant Reserve, or Biosphere Reserve

3) With primitive tribes residing here, the area has tremendous scope for ethonobotanical and anthropological exploration.

4) Horticultural, sylvicultural, agroforestry operations, should be taken up, along with afforestation to rehabilitate the degraded forests (due to 'Podu' and other operations), as well as the economy of the tribes. Added to this, forest based traditional cottage industries or tribal trades, like mohua, bamboo & cane crafting, honey, oil, medicine, leaf cup making etc., may also be encouraged, to build up the economy of the people, reducing the pressure on the forest.

5) The existing archaeological monuments should be properly protected and intensive excavation work undertaken, to discover archaeological monuments.

6) Educational programmes should be taken up to raise the level of eco-consciousness and also to eradicate social evils like drinking, which ruins the socio-economic life of the tribal poor.

In view of the facts, it is suggested that the Mahendragiri-singaraj-Devagiri system deserves be developed, as a Eco-Tourist centre (development of Tourism and Ecology). The elephant population is more than 40, therefore it may also be developed as an Elephant reserve.


Pix : Dr. S.N.Patro

Awareness campaign to conserve Mahendragiri and bring its past glory.

COASTAL ECO-SYSTEMS

Mangroves of East Coast in Orissa



Pix : Project Swaraiya, Cuttack

The 480 kms long coastline of Orissa, is marked by the confluence of ten major rivers into the Bay of Bengal, creating islands and deltas. In such a deltaic area, specifically on banks of the mouths of Mahanadi, Brahmani, Baitarani, Dhamara, Patsala, Subrnarekha, Budhabalanga and Devi, along with the Nalabana area of Chilka, is found tidal swampy vegetation, called mangroves. Adapted to the high and ebb tides of the banks of the river mouths, deltas and islands, the mangroves of the Orissa coast, are as ecologically rich as the Sundarbans of West Bengal.

ECO-SENSITIVE COASTAL ZONE

The coastal zone of Orissa spreads over an approximate area of 22,800 kms, spanning over the 4 coastal districts of Balasore, Cuttack, Ganjam and Puri having a 550 kms coastline. Rich natural resources, easy means of livelihood and favourable socio-economic conditions make this region one of the most thickly populated and developed part of the state. It supports 36% of the total population and 43% of the urban population. Formed by the silt and sediment deposition of the Burhabalanga, Baitarani, Brahmani, Mahanadi and the Rusikhulya, the coastal plain is not only highly fertile, the "Rice Bowl" of Orissa, but because of its critical location and oceanographic processes it is one of the most dynamic of coastal environments in India.

The fertility of the coastal area is its wealth as well as the cause of its degradation. Thick concentrations of population and optimal use of land by them together exploit the richness of the coastal plains. This has led to the implementation of wrong methodology in agricultural practices, degradation of coastal vegetation felling of mangrove forests, conversion of forest areas for agricultural and aquacultural purposes, non-availability of grazing land in the outskirts of the village and conversion of coastal swamps, dune vegetation, grazing land etc.

The coastal plain is being slowly degraded because of both natural and human processes of interference that basically represent a conflict in the use of natural resources. The result is degradation of coastal wetlands, changes in the coastline, pollution, saline inundation, global warming and shifting of rivers, all of which need to be addressed seriously in terms of a sustainable management of the coastal zone.

CHANGES IN COASTLINE : SEA EROSION

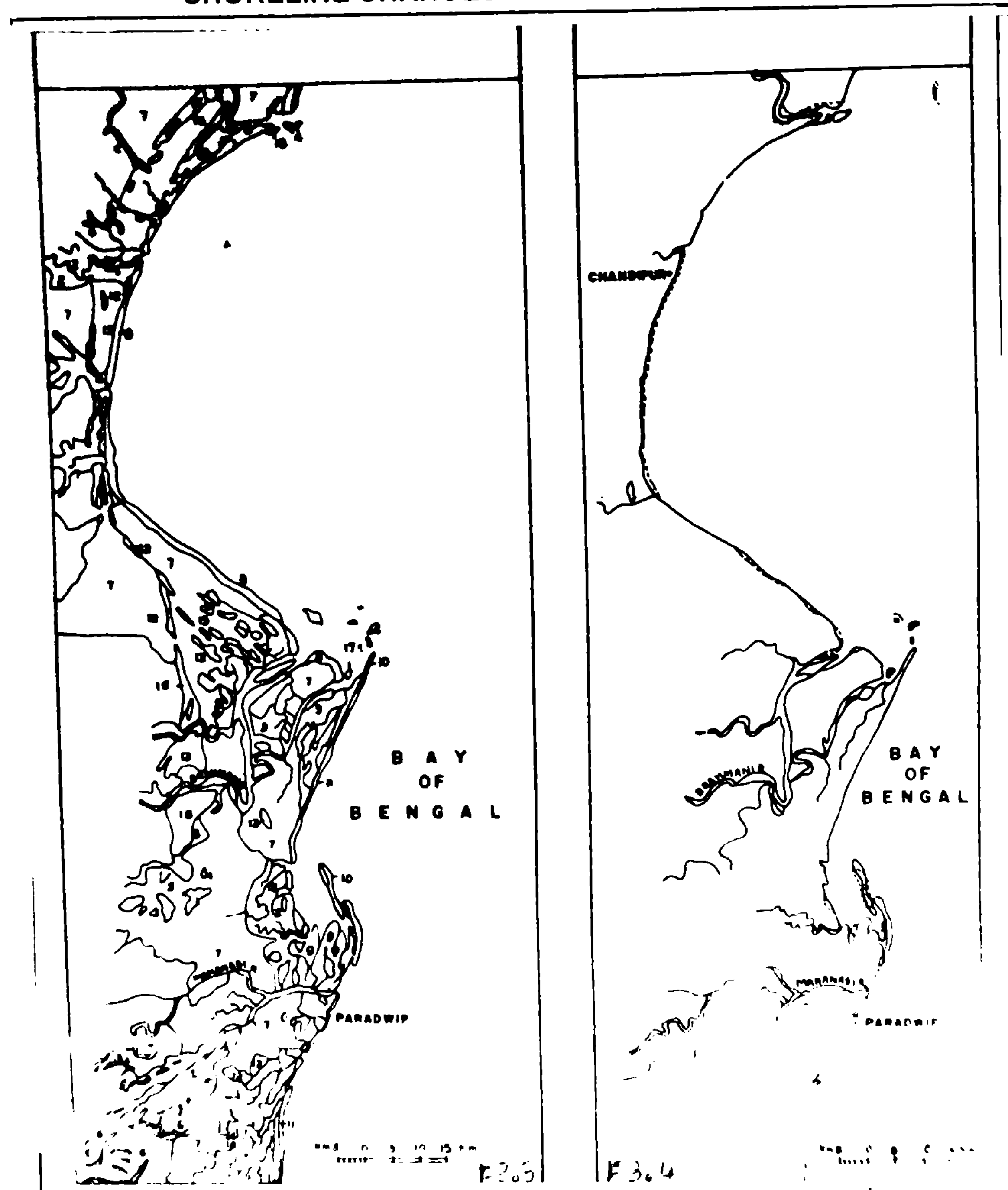
Orissa has been considered a "growing state" because of the deposition of silt and sediments at the deltas by the river systems. The land at Konark has extended into the sea by 10 ft per year over the past 700 years. However while one part of the coastline has been growing it is observed that there is erosion of the coastline at both Paradeep and Gopalpur coasts. The erosion is due to the reduction of the littoral drift that moves along the coast which in turn is due to the retention of sediments in storage reservoirs constructed on rivers and reduction in movement of drift material because of the harbour works both at Paradeep and Gopalpur. The state Government and the Central Water Power Research Station, Pune estimates that about 0.6 million cubic meters of nourishment would be required annually to maintain the status quo of the coastline at Paradeep.



Pix : Ghani Zaman for CPSW

The Coast Dynamics.

GEOMORPHOLOGICAL MAP OF ORISSA COAST
SHORELINE CHANGES MAP OF ORISSA COAST



Source : P.Kumar, Lecture Note, CZIS Workshop, 1994, ORSAC, Bhubaneswar.

Gopalpur port is also facing a similar problem. The CWPRS has recommended a layout consisting of an island break water with a sand trap at its lee, from where material could be dredged and bypassed to the northern side. Alternatively, another proposal consisting of a channel, protected by a breakwater on the southern side and a sand pump working over a trestle on the northern side for dredging and by passing sand from the channel has been recommended. These recommendations make it clear that down drift coast needs to be nourished by transfer of the material affected.

Area of Hukitola Bay between 1928-1984 : A recent survey has brought to notice serious erosion problems, in the small Hukitola area projecting into the Bay of Bengal. This area is about 11 km north of the outfall of the Kendrapara canal and within a distance of 15 km from Paradeep port. The actual survey conducted in 1979, when compared to the air survey map of 1929, goes to show that there has been an erosion to the extent of 5800 ft.(1768 m). The erosion at present is proceeding in such a manner, that this area, which is like a peninsula jutting into the sea, may get detached from the mainland and an island formed in the first stage. The report states that in course of time, this island may also disappear due to erosion, if remedial measures are not taken in time.

Such sequential studies indicate that perhaps a catastrophe (high flood/ cyclone) is responsible for the breach of the sand-spit at the mouth of Mahanadi and consequent forming of Hukitola island. But later the landsat images of 1975 and the Salyut-7 photograph of 1984 showed that the breach had repaired itself and then that the sandspit had completely vanished. Thus to say that erosion was solely due to the breach of the sand-spit would not be correct. There could be other causes too.

Table - 2 : Area of Hukitola during different periods

S.N.	Source	Year	Area in sq.km.
1.	Topo sheets	1928-29	15.85
2.	Aerial Photographs	1973	3.75
3.	Landsat - I	1975	2.64
4.	Salyut-7 (Kate-140)	1984	2.35

IS HIRAKUD RESPONSIBLE? : Such a question is not off the mark considering the results of the survey. Hirakud has prevented floods but it has also reduced the competency of the river

downstream resulting in high silting, rise of bed of the Mahanadi and its tributaries and decrease of silt discharge to the delta, thus being one of the major causes of erosion of Hukitola island. A computer enhanced FCE imagery in September 1975 confirms this. It shows that the sediment field of Mahanadi is only 66.18 sq kms whereas that of Dhamara (combined estuary of Brahmani and Baitarani) is 494.18 sq kms. Moreover, Hirakud which has a catchment area of 1,41,600 sq kms has only a peak discharge of 44,740 cusecs which is proportionately less than that of the combined discharge of Brahmani and Baitarani, that is 35,610 cusecs for a combined catchment area of 51,822 sq.km. It is clear that Hirakud is to some extent responsible for the erosion.

The Dyke at Paradeep : In the early sixtees an artificial random rubble dyke 450 meters long was built at Paradeep. This cut off the littoral current and the sand load it was carrying along the coast and endangering the Nehru Bungalow, North of Paradeep. It has also reduced the sediment deposit along the Bay.

The Winter (North-East) Littoral Current : A study of the Aerial Photo Mosaic of the winter season(December 1973) when the North East littoral current is active explains the genesis of erosion clearly. From the tonal difference and texture of the aerial photo mosaics, it is evident that the Bay, between the Hukitola island and the main landscape is rather smooth in winter, in comparison with the turbulent waves of the open Bay of Bengal, lying east to the islands. The tonal difference also shows the suspensed loaded current front. This winter littoral current gets deflected by dashing at the landscape lying south east of the Hukitola and travels along the sandy eastern shore of Hukitola till it meets the main littoral current, enters the smooth waveless calm bay lying west to the island in a whirling front and then enters in an anti-clockwise direction into the streams of the Hukitola island flowing in 'unripe' depressed valleys in between comparatively resistant sand bars. By this anti-clock wise motion the Hukitola island has been split into individually separate islands exposing itself more and more to the ravages of erosion.

Preventive Measures : To attribute the morphometric changes in Hukitola Island to floods or cyclones is only to hide the manmade blemishes, Hirakud and the Dyke at Paradeep which are mainly responsible for the erosion of the island. Since these cannot be done away with a near solution can be culled out from the already taken aerial photographs. Presently, however it is recommended by some scientists that a dyke may be constructed at the Northern extreme of Hukitola so as to divert the winter littoral current, block the mouths of the stream at Hukitola with random rubble and pump the dredging sand slurry from Paradeep to the shallow northern coast to help build the Island and prevent erosion.

Paradeep-Gopalpur East coast road : Preliminary investigations have been carried out for a proposed marine drive from Paradeep to Gopalpur as well as rail links using aerial photographs supplemented with satellite images. The impact of this must be seriously studied and people must be consulted.

Shifting of Rivers : Multi platform, multi-temporal & multi-sensor data in conjunction with historical data have been analysed to record the shifting of river Mahanadi and its tributaries. Palaeo levees, meander scars and point bars are the key interpretation elements to delineate the shifting of rivers.

Endangered Orissa's Mangrove Eco-system

Mangroves are nature's way of stabilising the coastline and shielding the landmass from tidal surges, cyclonic storms and heavy winds. The progress of the Mahanadi-Brahmani-Baitarani deltaic systems into the sea which varies from 5-50 metres annually is aided by Mangrove vegetation. The action of the littoral current from South to North along the coast of the Bay of Bengal and dumping of sand, silt and clay material by the Mahanadi-Brahmani-Baitarani system is responsible for creating the marine landscape of mangroves. These deep-rooted trees and grass species then reduce wave action and thereby check coastal erosion. Moreover, Mangroves having a density of 1.4 Km. provide a formidable wall against cyclones and storms which periodically hit the Orissa Coast.

This apart, Mangroves are rich in endemic species of fish like mullets, seabars, seats, milkfish and even the highly treasured *P.Monodon.* These Mangroves with their special physio-chemical environment serve as a roosting place for these fishes where they lay their eggs, rear their young ones until they metamorphose into juveniles and then migrate to the sea or reside there permanently. The Mangroves not only protect these young ones from intense sunlight in summer, from heavy rains and cyclones during the monsoon but also provide them with the most nutritionally rich feeding.

Habitation on coast.



Pix : Project Swarajya, Cuttack

However, human interference has put this natural heritage of Orissa in danger. Area estimates of Mangrove cover under dense and sparse categories as calculated from satellite imagery (see Table-2) show that there has been a definite degradation of Mangrove vegetation between 1985-1993.

Table - 3 : Mangroves Vegetation of the Orissa Coast.

(Area in sq.km)

Categories	1985	1993	Degradation
Dense Mangroves	185.34	176.62	8.72
Sparse Mangroves	31.78	22.57	9.21
Total	217.12	199.19	17.93

This degradation can be attributed to a number of factors. The lure of dollars has led to a rush for brackish water aquaculture or rather more precisely crustacean culture which has acquired pace since 1983-84 starting with a mere 23.51 hectares and going up to 7874.45 hectares in 1991-92. Ironically even the World Bank is aiding a 75 crore prawn culture project.

It is needless to say that the natural sanctuary breeding ground and nutrient sink of countless terrestrial and aquatic fauna is at stake. Moreover, with the development of sophisticated culture systems for *P.Monodon* with a stocking density of 50 per M^2 there is great stress on the environment of the pond. The deposition of mutabilities, excess feed and complication arising from the intense intraspecific interaction of a highly crowded shrimp population, deteriorate the water quality and result in poor growth and vulnerability to parasites and disease causing organisms. The use of excess food ranging from 0.972 ton to 19.44 ton over a period of 4.5 months results in the production of feacaes, urine and gasses (carbon dioxide & ammonia) through 80% convertibility of the food since only 20% is transformed into shrimp flesh on dry weight basis. These waste products are the major source of nutrients for pathogenic and non-pathogenic organisms. The result is pollution and diseases caused by protozoans. The use of chemicals like chlorinated hydrocarbons are most alarming. Though the damage through use of chemicals has not yet been assessed, it is a fact that chemical containing organo-phosphate as an active ingredient in them can kill fish if not allowed to degrade in the pond before being released to adjacent areas.

Diversion and blocking of natural channels also cause the degradation of Mangrove forests. The diversion and blocking of 18 channels at Atharbanki near Paradeep for the construction of industries resulted in the checking of sea-ward discharge of fresh water and consequently an imbalance in the salinity of Mangrove area thereby stunting the growth of its vegetation.

Another major factor which threatens the survival of Mangroves is reclamation and resettlement activities. The Rehabilitation of people in Satabhaya forests, the construction of a jetty at Bhitarakanika and the East Coast road from Paradeep to Gopalpur, the development of new and extension of old ports are some of the controversies which still engage the government and threaten the Mangrove forests of Orissa with extinction.

The pity of it all is that neither the unconcerned government nor the big businessmen will suffer direct loss if this heritage of Orissa is destroyed. It is only the helpless and poor inhabitants of the area who must bear the brunt of interference and destruction not only of the natural forces but also of the big business men with the support of the government. It is therefore necessary for them to protect themselves, their livelihood and environment. Only a people's movement is perhaps the only answer to the survival of Mangroves in Orissa.

BHITARKANIKA

Bhitarkanika wild life Sanctuary is situated between 20°.4' & 20°.8, N latitude and 86°.45' & 87°.9' longitude. Out of a 650 sq.km total area 350 sq.km. was under forest cover, while Bhitarkanika core is spread over an approximate area of 141.44 sq.km., including about 115,sq.km.s of mangrove forests. It has now been reduced to almost half, due to strong biotic interference.

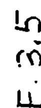
The core covers the area from Dangamal to Thakurdan river mouth, close to Satavaya & Gahirmatha coastal region. Due to regular inundation, tidal ebb & flow, the soil is mostly clay loam & highly slushy in nature. Regular deposits of humus makes the surface soil more fertile. Generally, the pit of soil varies from 6.8 to 7.3. A layer of silt loam and clay loam about 3.4ms in thickness, makes the surface soil.

Three main seasons are experienced in Bhitarkanika. April is the hottest month, with a maximum temperature of 45°C. Rains & storms are experienced occasionally, towards the end of summer. The transition period between rains and the winter, witnesses storms and oceanic cyclones, causing heavy rainfall, with the wind velocity ranging from 100 to 250 km/hr. The salinity of water changes from season to season, depending on fresh water flow from the river Bramhani, and salt water from river Patasola.

Flora : A few sporadic reports on the occurrence of mangrove species at Bhitarkanika, have been made by a number of experts in the past. L.K. Banerjee infers that the species concentration is more than the Sundarbans with approximately seventy plant species on record. The flora of Bhitarkanika can be categorised as (a) mangrove Vegetation (b) salt bush vegetation. Mangrove is well grown in the estuarine banks near the funnel shaped river mouth of Dhamara & Maypara, stretching towards the creeks & channels of the inner eastern regions. The local people derive all their household implements, from the mangrove forest. Some plants having high caloric value, are also used as fuel wood. In addition to economic importance for the inhabitants of the area the mangrove forests control the oceanic cyclones considerably and also the encroachment of the sea, by acting as shore levee stabilisers.

Mangrove taxa is arranged in two storied system, as Top storey & middle storey. Ground veg. is rarely found. Among the important one of top stories *Sonneratia* (Kerua) (Bani) *Avicennia officinalis,* (Dhala Bani) *A.alba,* (sundari) *Heritiera fomes, Xylocarpus moloccensis* (Pitamari) (Guan) *Excoecaria agallocha* etc. of which *sonnerntia apetala* is the dominant species. Some of the Mangroves having vivipary, pneumatophores, Knee roots, *Pongamia pinnata,* (karanja) a deciduous element found profusely away from the water body.

BHITARA KANIKA NATIONAL PARK



Source : Project Swarajya, Cuttack.

Among the dominant species of the second storey, some notable plants are *Khizophora apiculata*, (Rai) *Hibisius tinacess* (Bania) *Brownlowia tersa, Phoenix paludosa* (Heutala) *Clerodendrome inerme, kandellia candel* (sindhuka) *Aegiceras Corniculllatum* (Uanara), *Rhizophora mucronata* (Rai) etc. Rhzophora community is the centre of attraction due their position of kneeroots which seem partially inside water during tide. Height and girth of the Pneuma topbores indicate the age of the trees some times growing to 2-3 meters.

Drynaria guercifolia & *Hya Paralitica* only epiproytes are found in association with Derris & candens, *D. Trifoliata, caesalpinia nuga,* (Nentei) *dalbergia spirosa* (Goira) along the fringes of defunct creeks.

Among some ground dominant species *cyperus malacceasis, myriostachya* (tiansiorkeutia ghasa) (Nalighasa) *porteresia coarctata* (dhanidhana) are gregarious in muddy flats enjoying full inundation. Among some vulnerable, and rare species are *cerebra manghas* (Paniamba) (a small tree), *Acarthus valuables* (Harakorh a robust climber) & *Heritiera Kanikensis* (Kanikasundari) *H. littoraties* (Dhalasundari), *Intsia bijuga* (masitha), *amooracuculata* (Uanira), *cyrometra ramiflora* (singada), *xylocarpus mollucensis* (pitamari) *x. mecongensis* (pitakurua) and *Meropeangulata* (Banalemba) are species which require special steps for propagation.

Saltbush : Most xeric habitats are in abundance in the littoral tract of Sataviya and Gahirmatha. Some distinguished plants are *pomea pes-carpae Hydophylax maritima Bulbostlis barbata, Spinifex littorevs, cypeous arenarius.* These elements act as sand banders as well as sand stabilisers.

Fauna : Bhitarkanika harbours a number of reptiles, birds and mammals, some of whom are amphibious. Its compact vegetation, with innumerable biding places, number of water bodies & its climate, provides a suitable home for various wild animals.

The Sea turtle is an annual migrant reptile, visiting Gahirmatha beach. During their breeding season (Dec-March) every year about 1,00.000-2,00,000 sea turtles come for mass nesting, providing a spectacular sight.

The salt water crocodile, is another important reptile found in the rivers and creeks of Bhitarkanika. It has been reported, that the world's largest crocodile was killed in 1926, at Bhitarkanika.

A view of the core area of Bhitarkanika.



Pix : Sanjay K. Khatua.

The Saltwater Crocodile population suffered a dramatic decline after the postwar period, due to large scale hunting of crocodile skin and also due to the loss of their habitat. Bhitarkanika covers an area of 141 sq.Kms. and is the only mangrove habitat, out of the two main habitats in India, where saltwater crocodiles are available. The complex ecosystem of Bhitarkanika sanctuary is especially suitable for the survival of this type of crocodiles. But their population was only 25, as per the survey report in 1974 of Dr.H.R.Bustard, F.A.O. This includes a male of 23-24 length, perhaps the biggest in the world.

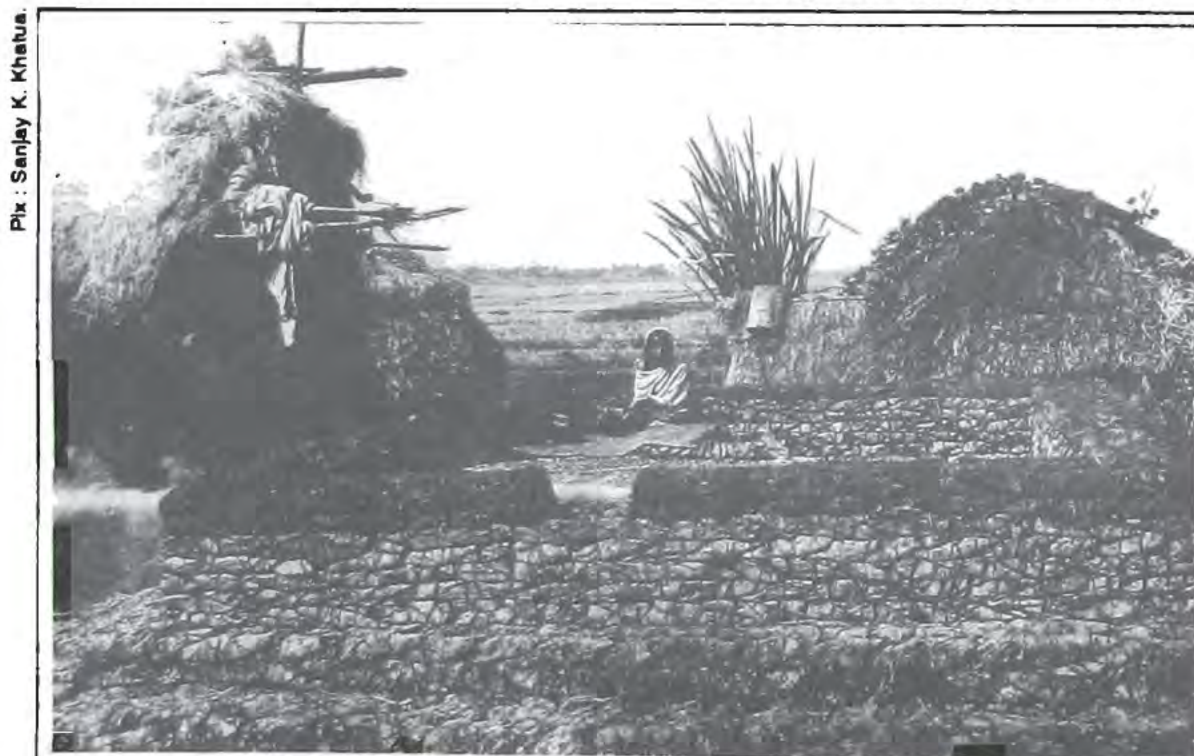
The earliest census during establishment of the project revealed that there were 29 breeding crocodiles, 6 sub-adults and 61 Juveniles in the entire Bhitarakanika Wild life Sanctuary. A rising trend has been observed in the census of the following years.

The last annual census (1988) shows that the survival of crocodiles in nature is 40% Presently there are 356 crocodiles of vaccine age group including a pair of white (local name Sankhua) being reared in the pools at Dangmal.

Table - 4 : Crocodile Census of Bhitarakanika Sanctuaries

Year of Census	No.of Adults	No. of Sub-Adults	Juveniles	Total
1976-77	29	6	61	96
1984	34	13	118	165
1985	39	10	162	211
1988	—	—	—	433

The last annual census (1988) shows that the survival of crocodiles in nature is 40% Presently there are 356 crocodiles of vaccine age group including a pair of white (local name Sankhua) being reared in the pools at Dangmal.



Pix : Sanjay K. Khatua.

Bangala Refugees in Orissa Coast. encroaching upon the coastal resources.

The basic objective of the Saltwater Crocodile Conservation Programme is 'grow and release' technique. It was realised that unless the wild population was strengthened by release of captive reared crocodiles into the wild, the depleted population would not recover.

To reduce the drastic loss of eggs and hatching in the wild, the wild laid eggs were collected from different forest blocks for project (hatchery incuba-

tion, hatching of young ones in the hatchery by stimulating the natural conditions). Rearing the young ones in rearing pools in captivity with sound husbandry conditions and release of the young ones into the wild after they attain more than 1 meter size, are being successfully taken up, under this conservation project.

So far 1050 young saltwater crocodile have been released into the suitable creeks and river systems of Bhitarkanika sanctuary and a few more are to be released in future. Regular monitoring of the activities of the crocodiles in the wild have been taken up. In addition to above releases, 25 juvenile salt water crocodiles have been supplied to other state crocodile Projects.

According to a report in 1985, 550 crocodiles consisting of 27 males and 523 females, have been released into the water bodies of this sanctuary.

Other aquatic Fauna are the water Monitor lizards, Mud skippers, Limulus crab, White cbis, Grey Pelicans, Barheaded Goose, Brambery are found besides Night Heron, Cattle Egrets, Collard Dove, King fisher, Water Touss etc. Python, King Cobra, Spotted Deer, Wild Boars, Chital, Jackal, Hyena, Porcupine, Fishing Ant, Mongoose, are also notable in this Sanctuary.

Realising the importance of conservation for this vulnerable ecosystem, the Govt. of Orissa declared the forest land & waste land, known as Kanika forest in Ali, Rajnagar, Pattamundai & Mahakalpada civil Sub-division in the district of Cuttack (including all creeks channels, wetlands & riverbeds situated in the areas), as Bhitarkanika Wild Life Sanctuary, in 1975. This Sanctuary was upgraded to the status of a National Park in 1988.

Some voluntary organisations have taken steps for protection & conservation of this area, but vested interests involved in forest clearance, shrimp culture, poaching of animal and clandestine export of king cobra skin and other money-making ventures, are powerful enough to nullify the efforts of the NGOs, who are yet to achieve a mass based movement.



Pix : Sanjay K. Khatua.

Signs left in Bhitarkanika Sanctuary of the Hunting Habits of the 'Rajas'

The Olive Riddle Sea Turtles coming to lay eggs are caught in nets and being killed.



Pix : Sanjay K. Khatua.

PROTECT AGAINST FISHING JETTIES : THREATENING THE TURTLES

The Gahirmatha beach of Bhitarkanika is one of the most ecologically sensitive areas in the World. Lakhs of Olive Ridley sea turtles, an endangered species, come here every year for mass nesting. The mass nesting of these sea turtles has been described by naturalists as one of the most remarkable phenomena in the world of animal kingdom. The rookery, one of the only four in the world, recently replaced the Mexico coast as the largest extant nesting site of Olive Ridley sea turtles.

But unwise even after the experience of Mexico, which was relegated to the second position owing to economic activities, the Orissa government is doing everything within its means to destroy this natural breeding place of one of the rarest species. As it is, the nesting area has come down to a small 400 metres stretch on an island in the northern end of the Gahirmatha beach after the heavy cyclonic storm of 1989 destroyed the bulk of the 10 km long nesting site. Cramped for space, the turtles unwittingly destroy nests built by themselves. This has serious repercussions for turtle population at Gahirmatha in the days to come.

But instead of doing something to protect whatever is left of the breeding ground, the government is going ahead with a plan to exploit the fishing possibilities of the coast in a big way. As part of the suicidal plan, the construction of a fishing jetty is fast in progress at Talchua-barely 10 kms from the nesting place. In spite of the setback it suffered when the major part of the construction collapsed recently, the government appears determined to complete the jetty. As if this was not sufficient, plans are afoot to construct three more jetties at Jambu, Kharanasi and Tantiapal - between Paradeep and Gahirmatha - on creeks near the sea beach in Mahakalpada block of Kendrapara district.

The Union Ministry of Forest and Environment recently wrote to the state government asking it to put an immediate halt to the construction of the Talchua jetty. Surprisingly, neither was an environmental impact assessment done nor clearance of the

Union Ministry of Forests and Environment obtained before initiating work on the jetty. Why, even the consent of the Forest Department of the state government was not deemed necessary. Obviously, economic reasons and electoral considerations far outweigh concern for the environment in the eyes of the Govt.

The sea turtles are under a twin threat. On the one hand, these jetties, when complete, are sure to restrict their movement to the Gahirmatha beach. The Talchua jetty alone would anchor 500 mechanised boats laden with 50 tonnes of fish daily - enough to scare away these sensitive creatures. On the other, there is the ever present danger of their being caught in the huge plastic gill nets, some of them 2 kilometres long, in use at present. Once trapped, the turtles are fatally injured by the propellers of the fishing trawler, often leading to death. There is a strong case for introducing of Turtle Excluder Device (TED) - a simple, low-tech, inexpensive device mandatory in USA - which allows the turtles to escape unhurt. Though this goes fine with the government's plans to exploit the fishing resources of the area, it is yet to wake up to the need for its immediate introduction.

Environmentalists have demanded an immediate halt to economic activities in general and construction of jetties and prawn culture in particular in the area. They have also made a plan for declaration of the Gahirmatha beach as World heritage Site in view of its fragile eco-system, pending which the Government of India may designate the entire area as a Biosphere Reserve. The least the government can do, they maintain, is to declare that Gahirmatha area, including the coast and at least 20 kms into the sea, as a Marine Sanctuary and ban fishing activities in the area. But given the determination of the state government to destroy this priceless gift of Nature, the battle of the environmentalists promises to be a long-drawn and hard-fought affair.

Meanwhile a PIL has been filed in the Orissa High Court by World wide Fund for Nature (India) an international environment and conservation organisation.

WET LAND ECO-SYSTEM

Wet lands represent a transition zone, between terrestrial and aquatic systems, with diverse ecosystems, such as lagoons, marshes, swamps and flood plains. The different wetlands vary widely in ecosystem attributes, including characteristic biota, species richness, productivity and the amount of organic matter accumulating in the sediment.

A number of wetlands have been encountered all along the coastal plains and most of them are estuarine in nature. The largest among them is Chilka. This lagoon is believed to have been formed 5000 years ago. It is connected with the sea, by a outer channel having a mouth that shifts from time to time. The rivers Daya, Bhargavi, Salia and Malaguni besides a number of small streams join the wetland. These rivers, estimated to carry about 13 million tonnes of silt a year, have rendered the lagoon shallow over the years. The average depth is less than 2 metres and shows a gradient north-south.

Siltation, encroachment and unplanned management are the problems facing the coastal wetlands of Orissa which form a unique ecosystem by themselves. Already, the wetlands of Chilika, Samang, Sar, Jatadhar Muhan and the lensoid water bodies of Chatrapur and Bahuda estuarine regions are in danger from both natural and anthropogenic sources. A detailed analysis of the problems besetting Chilika, Bhitarkanika and Anusupa are discussed in the chapter on Natural Heritage.

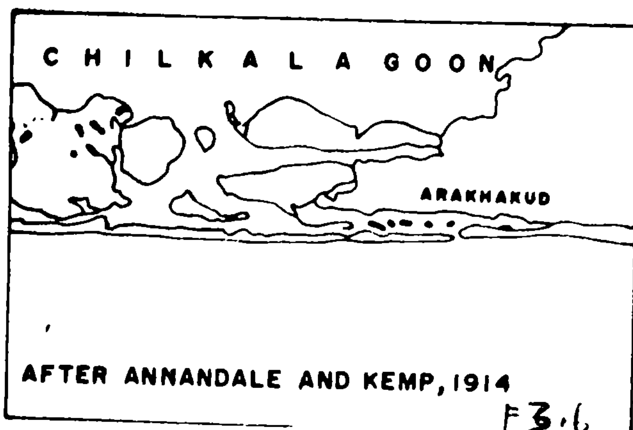
Table - 5 : Area of Wetland Categories of Orissa Coast

		Category	Area (in sq.km)
1.	Non Vegetated wetland		
	i)	High tidal/supra-tidal mudflat	56.6
	ii)	Intertidal mudflat	74.6
	iii)	Subtidal mudflat	120.1
	iv)	Sandy beach	120.3
	v)	Bars (Barrier island/mouth bar)	31.6
	vi)	Beach ridges/Swale	75.1
	vii)	Tidal flat	34.7
2.	Vegetated Wetland		
	i)	Dense mangrove	108.5
	ii)	Sparse mangrove	84.4
	iii)	Other vegetation	143.3
3.	Waterbodies		
	i)	Lagoon	790.0
	ii)	Others	7.7
4.	Shoreland		
	i)	Flood-prone areas	503.1
	ii)	Ox-bow lake	5.3
	iii)	Point bar	11.1
	iv)	Meander scar	18.4
	v)	Palaeomudflat	2405.2
	vi)	Coastal dunest	64.7
	vii)	Palaeochannel	19.4
	viii)	Abandoned channel	12.5
	ix)	Palaeobeach ridge	332.6
5.	Other Features		
	i)	Salt pans	14.4
		Total	5133.60

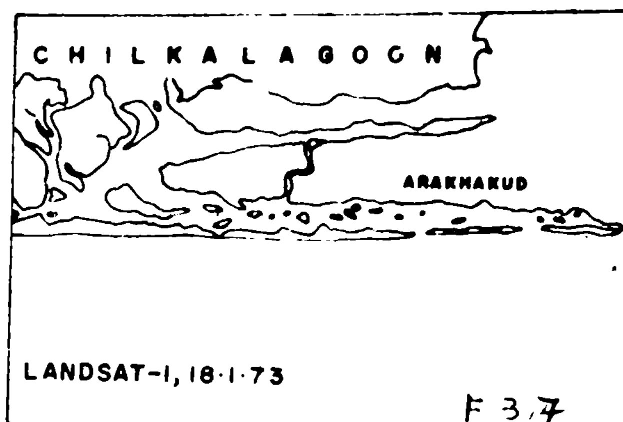
(Source : Coastal environment eac. Scientific note, 1992)

CHILIKA LAGOON

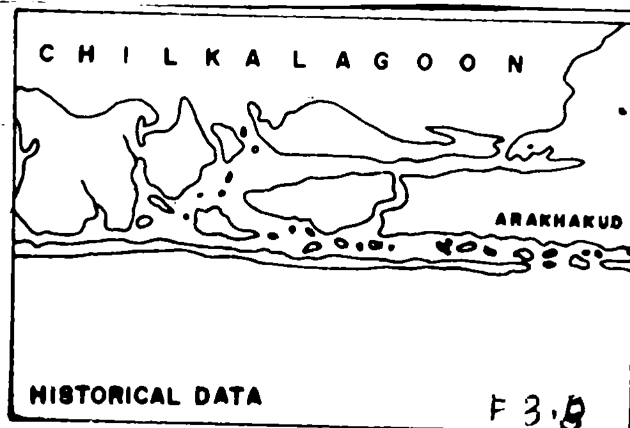
Chilka is the largest brackish water lake, or lagoon, in the Indian region. Studded with numerous hillocks and islands in its water, the lagoon is an extremely beautiful place. The lagoon and its surroundings are enriched with varieties of aquatic and terrestrial fauna and flora. It is one of the best resorts for resident and migratory birds. Among the wetlands of India, Chilka occupies a pride of place, as the only lake in Orissa, out of the two in India, declared as a 'Wetland of International Importance' under the IUCN sponsored Ramsar Convention (1971). There are 434 such water bodies in 52 countries and 40 in Asia, under this convention.



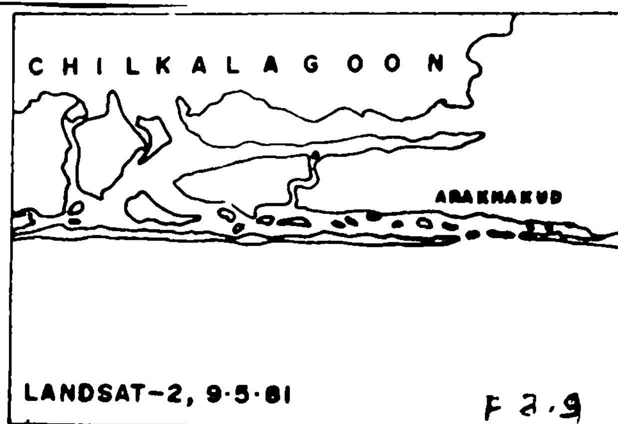
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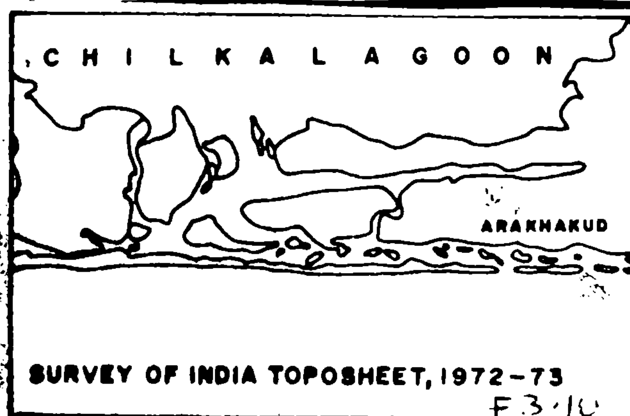
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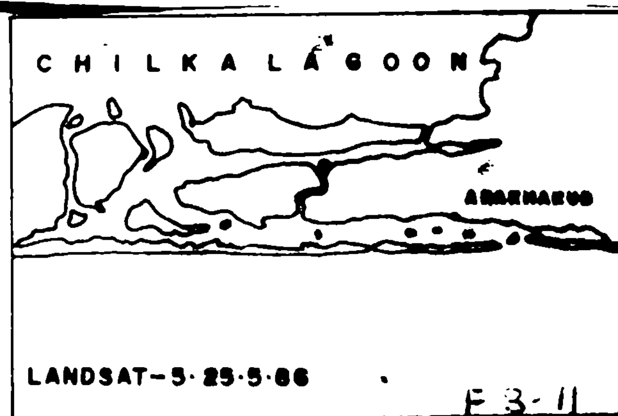
F 3.8



F 3.9



F 3.10



F 3.11

Location, Geomorphology and Climate : The lagoon is situated on the East Coast of Peninsular India and connected to Bay of Bengal. Extending from Bhusandapur of Puri District in the North, to Rambha-Malud of Ganjam District in the South, the lagoon lies between 19.30'-19.57' N latitude and 85.5'20"-85.29'20" E longitude. It covers a vast water area of 1055 sq.kms. which swells to 1,165 sq.kms. during the rainy season and shrinks to 906 sq.km. during summer.

According to remote sensing studies, the original area of 2,200 sq.km. has now shrunk to 916 sq.km., out of which 400 sq.km. is occupied by weeds and sediments. Therefore the actual total water spread area of the lake is 516 sq.km.. The lake is 72 km. long from the northern to the southern end while its maximum breadth is 18.5 km. in its northern part.

The depth of water is quite uneven and ranges from 0.47 to 3.0m in different parts of the lake, the average being 1.5m. During summer it varies from a maximum of 2.4.m in the southern section, to a maximum of 0.9.m in the northern section. The water level rises to 3.7m above mean sea level during monsoons. The salinity of lake water shows sharp annual cyclic change of 0.20% in November to 15% in May-June.

The lake becomes sweeter (less saline) from July to December due to a rush of flood waters from rivers. It becomes salty (more saline) from December to July as the supply of flood waters is cut off when south winds begin to blow and saline waters rush in from the Bay of Bengal through Mugger Mukha at the time of high tides. Thus the lake maintains a sweet-saline environment.

Chilika is an unique semi-enclosed pear shaped body, formed by a wave built barrier (Sand Spit) on a gently sloping shoreline, in an elongate basin parallel to the coast. It is connected to the sea by two openings. The first one is the sand bank which forms a natural lake mouth called Mugger Mukh. This is 60 meters in width and opens only during the peak monsoon period. The other one is an artificial canal about 5 meters in width and 12 km in length. Both these openings are shallow and not navigable.

Of the total area of 1,055 sq.km. about 223 sq.km. come under hills which lie scattered both inside the waters as islands and around the lake. Honeymoon, Breakfast, Kalijai, Nalabana, Barakuda, Sanakuda, Ghantasila, Chadeihaga, Arakakuda and Kanksda kuda are the major islands. The soil in a greater part of the lake, is formed of recently deposited clay. Black cotton and

sandy loam soils are occasional on some large islands. The rock formation belongs to the Eastern Ghat group, which is Archean, comprising of Khondalites, Charnokite and Granite gneissus. The chief rock types in the environs are Khondalites, unclassified Granites and Gneissus, Charnokites and Orthosites, Granulites, upper Gondawanas, Latterite and Alluvism.

The predominant minerals are Ilmenite, Garnet and Sillimanite and the minor ones are, Monazite, Rutile, Zircon, Leucoxene and Kyanite. Among others Copper, Lead, Zinc, Nickel, Chromium and Uranium. Preliminary studies have indicated increase of Uranium, along with the increase in salinity.

The climate of the region is moderately salubrious and is characterised by an equable temperature, and high humidities through out the year. The area records annual rainfall in the range of 1140-1170 mm and the temperature of the lake water varies from 17.5°C in January to 31.5°C in July. Wind velocity is usually high all through the year and turns violent during the summer.

Chilka is feared to be under severe stress of environmental degradation. The average salinity dropped from 22.31% in 1957-58 to 13.75% in 1960-61 and 9.85% in 1985-86.

Multithematic studies have thrown light on the rapid deterioration of the wetland environment. The shrinkage of waterspread at the rate of 1.6 km/annum and the enormous increase of aquatic weed mass are alarming. The other important change that has come over the years is the establishment of freshwater weeds like water hyacinth, water lettuce and sedges in the northern part of the lake.

The 65,000 fishermen living in and around Chilka depend on it for their livelihood. Their activities like fishing, boating, cattle grazing and disposal of domestic waste have an adverse impact on the environment. Migratory birds use the lagoon as their winter resort and come in large numbers, attracted by rich and available food supplies.

There is an urgent need to implement measures for improving the wetland environment, besides making provision for ingress of more tidal water from the sea, by dredging the narrow Magarmukh area. Some conservation measures like natural forest conservation and massive plantation in the upper reaches is needed to check free flow of silt through rivers. The existing weed mass needs to be eradicated by partially harvesting and utilizing its compost for agricultural use and as inputs in the digesters of biogas plants, that needs to be established in the surrounding villages. The other suggested measures include introduction of weed eating fish like grass crap, erecting pens on the western margin of the northern and central sectors to stock triploid grass crap (a sterile breed) etc. These pens can be leased to poor fishermen communities.

'Kalijai' Temple - Synonyms with Chilika - the "Mother"



The use of peripheral areas of Chilka for shrimp farming should be done, after careful consideration of its long range effect on the water holding capacity of the lagoon. Pen and cage culture yielding more than 1000 kg/ha of shrimp in two to three months should be considered as a source of sustained income for the poor fishermen owning them. In the southern sector and eastern parts of the central sector, there is great scope for culture of agar producing algae. Sewage and organic pollution at certain points, is a real threat to the fragile ecosystem and efforts to prevent this is of prime consideration.

Watersheds : About ten rivers and rivulets pour water into the lake. Notable among them are Malaguni and Daya (the deltaic branches of river Mahanadi), Bhargavi, Mandakini, Kansari, Salia, Mukar, Kusum, Baghachhala etc., The lagoon is regularly subjected to tidal inflow from the sea as well as run-off from the above mentioned rivers and rain water from the hinterland.

Flora : The lagoon is endowed with aquatic as well as terrestrial plant species. There are 352



Pix : Ghani Zaman for CPSW.

156 species of fish and prawn of brackish water type is an (slide) important gift to its people and Orissa.

150 species of Migratory Birds (slide) come to the lake, making it a paradise.



Pix : Ghani Zaman for CPSW.

and 28% others. There are around 120 fishing villages in and around Chilka with a population of 65,000 fishermen depending solely on the lake for their livelihood. Deterioration of the lake ecosystem has caused a threat to their life, and infusion of the business houses for prawn culture would add to their miseries.

angiospermic species belonging to 277 genera under 496 families, in the lagoon area. The vegetation of the area, depending upon the local habitat conditions comes under three categories, namely (a) aquatic vegetation, (b) littoral scrub jungles and (c) psammophytic vegetation and sand dunes.

Fauna :Chilka is most enchantingly attractive because of its colourful avifauna both resident and mirgratory. While large flocks of birds are scattered throughout the lake, the major concentration in terms of species abundance is on a small island called 'Nalban' (meaning weed covered marsh in Oriya), having an area of about 15 sq.km. It is a shallow, marshy island, (which remains completely waterlogged during the rainy season and the major part of the winter season and dries up gradually when summer season sets) providing feeding conditions for different species of birds.

The wetland ecosystem is changing at an accelerated pace and the authorities must move fast to save it, before it is further degraded environmentally.

The lake experiences roughly two seasons for birds (i) the rainy season (October to March) when many migratory species visit (2) the hot dry season (April to September), when the number of species drops to its yearly low.

It is recorded that the lake hosts about 150 species of birds in the peak migratory season. Of these 32% are aquatic, 22% are waders and 46% are terrestrial. Out of these, about 27 species are indigenous. Birds like Cormorants, Pond Herons, Egrets, Smipes, Stints and Winter Fowls are plenty in Chilka lake, throughout the year.

The lake has 158 species of fish and prawn. Out of this 27 are fresh water and 131 are marine types. There are also delicious over-sized crabs. Among these, 10 fish species, 4 prawn species and 2 crab species, are commercially important. About 4,000 M.T. of fish landings per year on the average are reported, of which roughly 31% constitute prawns, 29% mugils and 12% perches

Table - 6 : Migration of Birds from Different Regions

S.N.	Name of the bird	Region from where migrate.
1.	Pin tail duck	Casparian region in siberia
2.	Red Crested pochard Duck	Lake Baikal.
3.	Common Teal	East of Kirghiz steppes.
4.	Gargany or Blue winged Teal	Kieva region of USSR
5.	Ruddy Shel Duck or Brahminy Duke	Ladakh and Tibet Region.
6.	Shovellers	Kazkh and Siberia
7.	Bar-headed Geese	Ladakh
8.	Bar Tailed and Black Tailed Godwist,	Casparian Sea.Red Shanks Green Shank, Turnstone, Marsh Sand Piper, Asian Dowitcher, Common Sandpi per, Little stint, Temminek's stint, Eastern Golden & other plovers.
9.	Flamingos	Ashk Islands in the Rezaiyesh lake of Iran and Gujrat.

The lake is also rich with phyto and zooplanktons. Besides there are also terrestrial wild animals in surrounding sand vegetation, hill forests, bushed and scattered islands. Some of them are Black Buck, spotted deer, fox, Jackal, Hyaena, Jungle cat, Hare, Rat, Pachyura, Common bats, Otter, Common Mongoose, Squirrel, Porcupine and many others.

Eco Degradation of the Lagoon : Heavy siltation, rapid growth of aquatic weeds, shrinkage of water spread area, overfishing, poaching of birds are some of the major threats to the lake.

1. Majority of the inflowing rivers are located in the north-east side. The increased quantum of sediment input in the north-east, accounts for the shallowness of the lagoon in that section. It was

Siltation of the lake is caused not only due to the hills inside it, but also from 45 nos of rivers and streams flowing to it.



Pix : Manoj K. Pradhan

In 1973, weeds covered nearly 20 sq.km. of the lake, which increased to 244 sq.km. in 1985. Some of the weeds are food for fish, but others cause a nuisance. The dead weeds add to the organic matter forming peats and increase the shallowness of the lake. This hampers fishing and other activities.

Organic matter due to decomposition results in Oxygen depletion below critical level, causing 'Eutrophication' and algal blooms draw excessive oxygen, because of increased BOD (Biochemical oxygen Demand). The low oxygen values in the pen water, indicates sources of pollution, probably from the decaying vegetation. (Oxygen content of surface samples 6.7-7.5 mg).

3. Pollutants from industries in the catchment area, use of Chemicals and fertilisers for intensive agriculture are some of the

estimated that an enormous load of 13 million tonnes of silt enter the lake annually and render it shallow, (1.5 sq.km. annually) turbid and form a substratum characterised by loose mud. Siltation has reduced the depth of Mugger Mukh to 30 cm. and cut off the linkage of Palur Bay with Rushikulya estuary through palur canal. The average depth of the lake was 2.4m in 1924 whereas it reduced to 0.51 to 1.6m in 1991.

Decades back there were about 13 openings between the lake and Bay of Bengal. Siltation has now closed all the openings except Mugger Mukh and Palur Canal. The total life span of the lake was estimated as 10,000 years. Today it is already 5,000 years old and should live for another 5,000 years. But in reality, the pace at which degradation is taking place may cut short its life to 400 to 500 years only.

Siltation is reducing ingress of sea water into the lake and hence affects mixing of sea and river waters. The overall salinity average for the whole lake has dropped from 22.31% in 1957-58, to 13.20% in 1960-61. The salinity varies from 5 to 10 ppt seasonally and sometimes approaches zero value during the monsoons. Particularly in the northern sector, near Rambha the water has a higher salinity (9-19ppt), but it needs to be raised to 15 ppt at the minimal level.

2. Eutrophication is a problem, in the lake which is more pronounced in northern sector. *Potamogeton pectinatus* and *Najas faveolata* are the two principal aquatic weed species that constitute about 78 and 14 percent respectively. The former species grows well at any depth of water and withstands wide variation of salt concentrations.

changes put into the lake and the outer channel. It was observed that concentrations of mercury in the southern sector, were alarmingly high. The source of mercury is believed to be from a Chloroalkali plant at Ganjam, which discharges industrial effluents into the river Rushikulya, upstream of Palur Canal.

Oil from bilge water of the Naval Cadet training ships (Naval Training Centre was established in 1967) and power driven boats, are being discharged into the lake. Nitrites and nitrates are also detected. Heavy metals like copper (5-14ppm), Lead (72-75 ppm)

Pix : Manoj K. Pradhan



Movement and closure of Chilika inlet to sea reduces the salinity of the lake and blocks the communication of the fishermen : The dredging operation inaugurated by the C.M. of Orissa in 1992 was found problematic. There is a need for careful intervention.

Zinc (38-48 ppm), Nickel (135-215 ppm) and chromium (30-40 ppm) are also reported. Carbonate content varies from 1.6-3.8%.

4. The annual fish output of the lake on a average amounts to 6,500 tonnes. The output is showing a downward trend since 1970. This may be due to several factors, like intensified fishing in the inshore and offshore waters, use of nylon nets, catching of fingerlings and over-exploitation of prawns. Aquaculture between Arkakuda and Satpura is a threat to dolphin movement. Decrease of phytoplanktons and fall in salinity are some of the reasons also assigned to decrease in fish population.

The point where marine water enters the lagoon, as well as the palur canal at the confluence of Rushikulya are blocked due to siltation. Therefore sea fish are not able to enter the Chilka waters. Khainga fish, which contributes to 30% of the total fish production, stays in Chilka for two to three years and then moves towards the deep sea to lay eggs. Once they enter the deep sea the fish do not return to the lake until seeding stage. The fish while entering the deep sea is caught by the fishermen. This is commonly observed near Satpada estuary. Similarly juvenile prawns of the size of 2.5mm are being caught in scoopful (each scoop a few lakh juveniles).

5. The local mafia and the refugees from Bangla Desh settled here resort to uncontrolled shooting, netting and snaring of birds. It is understood, that at least 15,000 migratory birds are caught and sold every year from the Chilka bird sanctuary. The refugees earn fabulous sums by selling birds.

The mangroves and other terrestrial species, which were once plentiful on the fringes of the lake and the islands are no more seen. As a result birds do not get shelter. Therefore the number of birds migrating to the lake decrease.

6. Between maximum (1,165.5 sq.km during monsoon) and minimum (906 sq.km during summer) water spread areas, the peripheral (259 sq.km) area remains dry for more than 8-9 months in a year. By raising temporary embankments, people encroach into this area for cultivation, therefore, over time the lake area gets squeezed.

Protection & Conservation Measures : Chilka was given the status of Protected Forest, under Khurda Forest & Shooting Rules, 1972. Its status was elevated to a Bird Sanctuary in 1973 and 'Chilka Sanctuary' in 1981, with a view to protecting and developing wildlife, including birds and fish. In 1991 a 'Chilka Development Authority' was constituted. Mere enactment of protection Rules will not help protection and conservation of lake ecosystems. It requires an integrated management plan, with promotion of peoples awareness. The following measures are suggested in this direction :

1. The Mugger Mukh and Palur Canal may be dredged (75 sq.km area may be excavated at the minimum) and deepened for ingress of sea water into the lake. This will help raise salt concentration of the lake waters and reverse the trend of natural succession.

2. Measures must be taken for natural plantation and regeneration of forests in the watershed and catchment areas to prevent soil erosion and siltation in the lake. Plantations in the Daya-Nuna-Bhargabi-Malagumi-Salia basins, covering Brahmagiri-Kanas-Tangi-Banpur Blocks should be taken up in the first phase, with immediate effect. The Eastern embankment of 200 mt width and 2mt height should be constructed around Chilka, to prevent siltation through overland flow.

3. Many of the indigenous tree species perched, nested and nestled by birds are now lost. Therefore all the islands, more particularly Nalbana, Bhasramunda, Chadeihaga, Breakfast may be protected for regeneration of the lost species and planted with selected species to shelter the birds. Outside the lake, towards the western side, there are hills and hillocks, which should also be brought under plantation.

4. The proliferated growth of weeds should be controlled by biological control, through introduction of grass-carp or any other suitable herbivorous fish species, like triploid grass carp (sterle), or by manual uprooting

5. Exploratory work on the present status of flora and fauna and research work, may be promoted, to study the biological and ecological features of the lake ecosystem.

6. The Sanctuary should be properly managed and steps be taken for socio-economic and educational development in the area.

About 60,000 people in 114 villages living around Chilka depend on it, for earning their livelihood. They may be suitably trained in fishery conservation methods and adoption of modern fishing practices. Since the lake is rich with natural food, monoculture and polyculture of brackish water fish, prawn and mullet, can be developed, by enclosed fish pens along with measures like Prescription of appropriate meshsize nets, restriction of fish catch, prevention of domestic animals from grazing etc.

Above all, conservation of the ecological wealth does not depend on only government legislation, it requires a combined and coordinated effort at government and non-government level. NGOs' like Orissa Environmental Society, Nature and Wildlife Conservation Society of Orissa and a few others are putting some efforts to work on this line. And now even Canada International Development Agency (CIDA), is providing 52 crores to the State government, for alround development of the lake.

7. Closely linked to the protection-conservation issue is the conflict generated between the proposed Chilika Aquatic Farm (Jointly undertaken by the TATAs and the Govt. of Orissa) and the locals who oppose it. The government has suspended work on the farm pending an Environmental impact assessment but this is no solution. The goal of "Chilika Bachao Andolan" should not end with driving out the TATAs, it should ensure that Chilika is free from eutrophication and pollution which are ever present dangers threatening Chilika with destruction. In spite of a national seminar on the Conservation and Management of Chilika (in 1988) where detailed action plans were laid out and responsibilities shared with different government departments and other agencies. Yet nothing concrete has so far been achieved.

PEOPLE'S MOVEMENT TO SAVE CHILIKA

For over a lakh people in 192 villages and its 50,000 fisherman, Chilika is the source of livelihood and sustenance. Fishing has been the traditional occupation of these people for centuries and their rights to fishing can be traced back to the Afghan rule in Orissa. They enjoyed the same rights even during the British rule when the first fisherman's cooperative was formed at Balugaon in 1926. This was probably the first such cooperative in Asia and was followed by 25 more.

This rare and inspiring history of fish production cooperative and village level democracy was further formalised by the formation of an apex Central Fishermans Cooperatives Society limited in 1956 at Balugoan. By this the Orissa Govt. leased all fishing rights to the central cooperative which in turn sub-leased smaller areas to 65 primary fisherman cooperatives. Thus a system of ecologically stable co-existence between the fishermen committees, the lake and its inhabitants developed and continued thus without outside interference till the late 1970s.

The years 1977-78 saw the development of prawn as an important export commodity. First the unscrupulous traders and middlemen, then the politicians with their musclemen, a handful of big business families of Orissa and their local middlemen and mafia, and finally, the big industrial houses, with the blessings of the state government, which was now very keen to usher in 'development' to the region, displaced the local fish producers and gained control over most of the prawn and fish trade opposition was natural. The fisherman stood against the huge extortion and violence unleased by the competing mafias. They went to the courts so much so that the very name Chilika brought lawyers swarming like bees to the court in Bhubaneswar. The result was that lakhs of rupees from these village went into the pockets of administrators, politicians, lawyers, police, touts and even some judges at Puri, Bhubaneswar and Cuttack. However, the outsiders stayed on.

In 1986, the then Government decided to exploit the resources of Chilika even more systematically. Their choice as a partner in exploitation was, aptly, the premier house among Indian industrialists, the TATAs. The proposal was to lease out 1,400 hectares of prime prawn areas from the Chilika to a company to be formed jointly by the TATAs and the Orissa government.

The WAPCOS Study

The Environment Impact Assessment study was commissioned by the project through the consultancy agency, WAPCOS. The favourable report, totally ignored the vital aspects of the project, its impact on the livelihood of fishermen of that region, the impact of the embankment on the surrounding regions and pollution threat to the living organisms of the lake.

THE CHILIKA BANCHAO ANDOLAN

In the wake of these developments, a people's movement emerged in Chilika over the years, to protect it from commercial exploitation by big business, and to restore to the people their right to live in Chilika. A chronological account of various events is documented below :

August 13, 1991 : A meeting of intellectuals and supporters at Puri led to the formation of a platform "Chilika Surakshya Parishad" to coordinate the activities. The cause also received support from democratic rights organisations like *Swadhikar & Ganatantra Adhikar Suraksha Sangathan.*

September 20, 1991 : On this day, the three-year lease to the fishermen's cooperative societies was due to expire. About 8,000 fisher people from Chilika came to Bhubaneswar and gheraoed the assembly which was in session.

January 22,1992 : People objected in the court of the Revenue Divisional Commissioner (RDC) against advanced possession of the land given to the TATAs by the Orissa Government. A stay was obtained from the RDC on February 2, declaring the advance possession as void and restricting the TATAs entry to the disputed land.



February 16, 1992 : A gathering of 5,000 people consisting of fishermen and women, non-fishermen, students and intellectuals took possession of the TATA occupied Chilika area. They hoisted their own flag and declared a "People's curfew" in the area. Village heads from 62 villages pledged to continue their fight

against TATA's illegal occupation of Chilika.

March 7, 1992 : A rally of 1,000 women marched towards to the TATA site with the intention of breaking the embankment.

March 15, 1992 : A rally of about 6,000 people from Chilika villages marched to the TATA site and broke the embankment. Neither the presence of four platoons of police force, nor physical assaults by goondas employed by TATAs could stop the people.

Prawn culture has entered into the lake in mid-1980s and now has become a lucrative business. Traders from outside are buying leases and "mafia Raj" is ruling the lake. The High Court order in 1993 and Orissa Govt's decision to clear these high bunds has not been implemented yet.



Pix : Sanjay K. Khatua.

March 25, 1992 : People set up a check gate to obstruct the movement of TATA vehicles. It was removed later.

March 28, 1992 : Another people's march was announced to the TATA site. A battalion of 11 police platoons was deployed to stop the march. The police resorted to lathi-charge. 69 fisherpeople, including 33 women and six children were arrested. In spite of such fierce repression, the people continued with the act of demolishing the embankment.

April 4, 1992 : Chittaranjan Sarangi of the Andolan was arrested. About 600 students of the Utkal University gheraoed the District Collector of Puri, demanding the release of the arrested fisher people and Mr. Sarangi. On pressure, they were all released on April 9.

Under the leadership of Sri Banka Bihari Das, a rally and public meeting was organised at Bhubaneswar in which fishermen, politicians of different parties environmentalists and media people participated. Mr. Anil Agarwal, editor Down to Earth stressed upon community ownership and control over the local resources and their development. This meeting had very god impact.

May 13, 1992 : With the initiative of Sri Das, a letter was sent to the Prime Minister, signed by 21 MPs, which called for his immediate intervention in restraining the TATAs from executing the project. A memorandum was also sent to the Environment and Forest Minister. To press the matter, again in September 1992, a convention of representatives from 632 villages in four blocks to be affected by the TATA project was organised by the Chilika Banchao Andolan at Puri. There after, in the last week of September, the activists of Chilika Banchao Andolan and Krantidarsi Yuva Sangram undertook a 15 day padayatra to contact people and activate the movement.

The Orissa High Court played a very crucial role in 1993. It instituted a committee to look into all issues such as fishing,over fishing,fishing rights,ecological problems of the lake etc. and finally delivered a judgement in the fishermen's favour. The Hon'ble Court ordered eviction of all bunds on lake asked the Government went execute it. But, powerful lobbies and violence stopped this. The political commitment can be well judged from this. A series of all these events helped to create a public pressure and the division of power between the Centre and State (belonging to different parties in power) made the movement a temporary success. It is learnt that the structures created were removed, while on the other hand, the TATAs have started health services in the area. This is enough an indication that the project is not dead.

The TATA project is not the central point of the people's movement. The prime focus is the policy of the government towards Chilika and its people. The project is only an instance of this policy. The movement has to be more constructive and should continue its education and organisation process for effective and sustainable development of the resources and people.

We will loose the glory of the lake if the Migratory birds will not come.



Pix : Ghani Zaman for CPSW.

ANSHUPA : THE DEGRADED WETLAND

Anshupa lake in Athgarh Subdivision of Cuttack district of Orissa, represents a typical freshwater lacustrine ecosystem.

With its smaller geographical area of 1.71 sq.km., it is quite famous in the state, because of its crystal clear waters, attractive fishery species and enchanting environment. The lake is bounded by latitudes 20°28'03" N and longitudes 85°35'06" E. In the wide alluvial plain of Mahanadi well developed natural levees have grown on both side of river banks during the past years, through continuous vertical accretion. When flood recedes, the high natural levees obstruct movement of water resulting in a series of back swamps in the flood plain. Anshupa lake is one such back swamp formed in the immediate upstream region of the Mahanadi delta. It is surrounded by a number of hillocks in the north, east and west where Mahanadi flows to its south.

Anshupa and other back swamps, namely Kantapahnara Ostia, are connected through an abandoned channel which becomes active during floods. The discharge stream connecting Anshupa with Mahanadi is truncated by flood embankments. The surrounding area is almost barren with less vegetation cover. So during monsoons, huge quantities of sediments are transported to the lake through streams and overland flow. Fresh water flushing from Mahanadi has become almost a rare phenomenon.

These factors cause heavy siltation and rapid growth of hydrophyte within the lake. The proliferation of algae and growth of rooted as well as floating vegetation types are now considered prime factors affecting the lake eco-system.

The local geomorphology and its relationships with land use/land cover practices are among the important factors controlling lake environment. The study highlights geomorphological analysis, land use/land cover practices, drainage network, lake environment including water quality and eutrophic status and measures required for development and conservation of the lake ecology. Only three decades back the surrounding areas of the lake had dense vegetation on the hillocks and silt load into it was negligible. The fisherfolk of the locality were self sufficient with good harvest of fish, selling in the local and external markets. Within two decades this livelihood was completely lost.

Drainage : Drainage analysis indicated that the streams are usually slope controlled with low to moderate drainage density. The back swamps are main fed by over land flow and flood water.

Land use/land Cover : Land use-land cover analysis of the area around Anshupa indicates extensive agriculture land with rocky patches. Wastelands, degraded forest and barren rocks dominate the land cover type.

Suggested Measures to Prevent Eutrophication

1) Regular flushing of freshwater from Mahanadi to dilute nutrient concentration.

2) Construction of embankment around the lake to prevent direct nutrient inflow.

3) Scientific use of fertilisers in the surrounding agricultural fields.

4) Application of weedicides, introduction of predators and manual removal of floating weeds to control the growth of hydrophytes.

5) Chemical precipitation of nutrients and dredging of nutrient rich sediments.

6) Monitoring of the lake to be continued for a couple of years to understand the exact nature of the lake ecology and to evolve a management plan for lake development.

Conclusion : It is imperative that the Natural heritage of Orissa be preserved and protected at all costs. Government policies in black and white are useless unless the government has the political will, administrative capacity and know-how to implement it. In this respect NGO's and other voluntary agencies have to take the initiative, not only in supporting the conservation efforts of the government but also by working towards the creation of awareness of the value of ecosystems to those who live in them and yet do not make a sustainable use of it.

LAND USE AROUND BAHUDA ESTUARY



Source : P.Kumar, Lecture Note,CZIS Workshop, 1994, ORSAC, Bhubaneswar.

MANAGEMENT OF THE COASTAl ECO-SYSTEM

Over exploitation and unsustainable patterns of resource management have denuded the coastal zone to such an extent that there is almost nothing left for present and future generations. As population and commerce increase, there is proportionately an increasing demand upon shore areas for navigation, fishing, raw materials, housing, recreation, aesthetic inputs etc. Such a phenomenon calls for a sustainable management of resources to ensure their most efficient utilization.

Certain trends have to be changed. The practice of mechanised fishing which leads to over exploitation and conflicts between traditional fishermen and those using trawlers; fishing operations which trap all biodiverse species indiscriminately, fishing operations during the breeding season, mining of rare earths by the government, construction of highways without any environmental concern and all other such trends are to be dealt with evenhandedly and seriously so as to put a stop to all unsustainable practices in the coastal zone.

But all such steps face obstacles because coastal lands are not given due concern by the government. While many other countries treat their coast as separate entitles and by law, protect and restrict its use keeping in view their fragile nature and ecological significance, in India, the coasts come under the compass of laws governing land use and town and country planning. Moreover, by constitutional authority, the States of India have legislative competence on matters like land use, land conservation and land management including the multi faceted management of coastal land. With the absence of comprehensive legislation, it is seen that a number of bodies and authorities exercise power relating to coastal land management. This results in utter confusion and mismanagement because of the lack of co-ordination among these agencies. Moreover, these bodies are not equipped with personnel who understand the ecological significance of the coasts. The primary step for a sustainable management is therefore an overhauling of the administrative set-up and special laws to govern coasts.

COASTAL REGULATION ZONE

Happily, it is to be noted that the government of India on 19th February 1991 declared the coastal stretches of seas, bays, estuaries, creeks, rivers and brackish water which are influenced by tidal action (in the landward side) upto 500 mts of the High Tide Line (HTL) and the land between the Low Tide Line (LTL) and High Tide Line (HTL) as Coastal Regulation Zone (CRZ). These were classified into four distinct zones on the basis of the nature and degree of development in those areas. The CRZ not only regulated developmental activities on the coasts but also prohibited those activities which had an adverse effect on the coastal environment. It categorically stated that no construction (including temporary ones like fencing or other such barriers) be made within 200 mts of the HTL (in the land ward side) and within the area between LTL and HTL. It however allowed construction of hotels/beach resorts between 200 to 500 metres of the HTL with prior approval of the Ministry of Environment and forest subject to certain stipulated conditions. Moreover the CRZ-III took cognigance of areas (which did not come under CRZ-I or II) which were relatively undisturbed including rural areas (developed or undeveloped) in the coastal zone. It also prohibited certain undesirable activities like the discharge to the sea of untreated wastes and affluents from industries, cities/towns or other human settleemtns like slums & dumping of waste for the purpose of land filling or otherwise in the coastal zone.

The coastal regulation zone is much more comprehensive than the environment protection Act, 1986 which contained no specifications for the management of coasts. The CRZs however contain certain inherent drawbacks. These regulations make environmental clearance necessary only when activities within the CRZ involve the investment of five crore rupees. Besides the regulations do not make provisions for the establishment of a single agency to deal with the management of the coasts nor does it recognise that at least all the bodies dealing with the coast work with coordination so as to fulfill the goals laid down in the Environment (Protection) Act, 1986. Above all the enforcement of these laws have not been taken seriously and therefore, the regulations of the coastal zone have been flouted with impunity. (See case study on Puri).



Pix : Project Swarajya.

Habitations on the sea cause a lots of disturbance which people need to think about and regulate in future.

PURI : CORRUPTING THE COASTAL ENVIRONMENT

Situated on the East Coast, about 70 kms from the capital city of Bhubaneswar, Puri is famous as a pilgrimage centre and a beach resort. Earlier as a unifunctional religious town, Puri had registered a very slow rate of population growth. But after growing in importance as a tourist centre, it increased both in terms of population and spatially as well. This led to unregulated and unrestricted growth of urban settlements, slums, beach resorts, hotels and even industries within the coastal regulation zone especially on the eastern side of the town on the Sipasirubali and Baliapanda regions. The problem areas adversely affecting the coast was the conversion of residential accommodation into commercial use, construction of new hotels on the seaward side, development of slums & disposal of untreated sewerage into the sea.-

Studies reveal a visible change on the coastal regulation zone in 4 years between 1990-1994. New plots or buildings have been demarcated on the beach with boundary walls to identify them. Similarly hectic construction activity has started in many of the vacant plots of 1990. New hotels and holiday homes are sprouting within the 300 mts zone. More alarming is the fact that land, adjacent to the Mangala Nala which falls within 200 mts zone, has been reclaimed, leveled and construction started thereon.

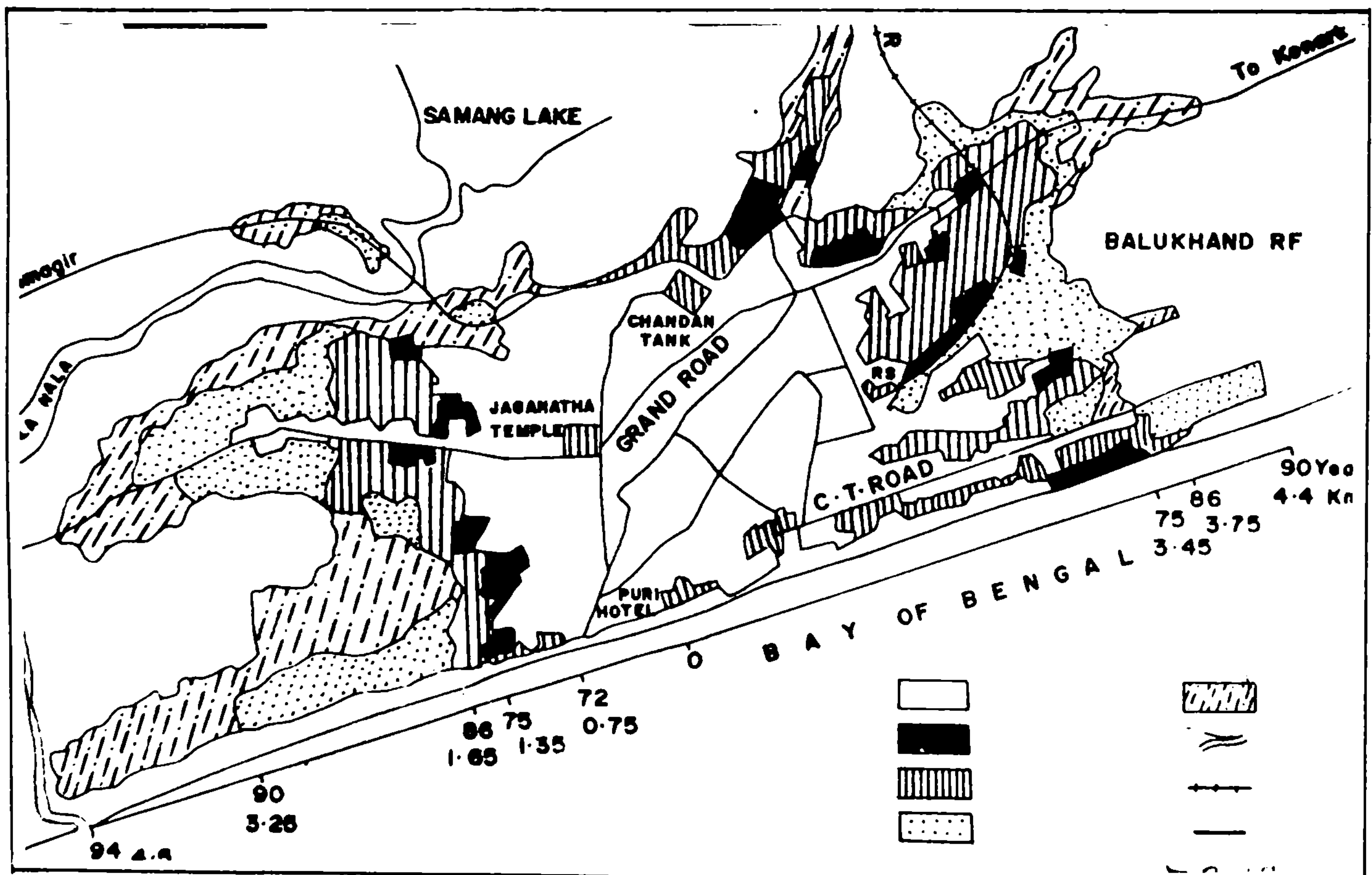
Simultaneously, plotted development is taking place within the 200 mts zone in the Sipasurbali and Baliapanda areas.

Slum development is another threat to the coastal environment. According to the Directorate of Town Planning, out of 29 slum pockets in Puri, nine fall within 500 mts of the HTL. This is grossly underrating the violation of the CRZ. The fact is that, Penthakata, the largest slum pocket of Puri, is located just 40 mts away from the HTL. It has a total population of 24,835, which is 44% of the total slum population and it covers 113 acres of beach sand area. Of these nine, namely, Baliharijan sahi, Balimochi sahi, Dhoba sahi, Nolla sahi, Jail area, Tiadi sahi, Harijan basti, Chakratirtha nolia sahi and Bali sahi are situated unauthorisedly over revenue land. Most of the slums of Puri are made of bricks and are semipermanent structures except Penthakata slums, which are made of temporary structures without infrastructural facilities. However slum development is going on unabated in the Baliapanda area under the eyes of the town planning authorities.

Untreated sewerage disposal, new waste dumping sites and land filling has increased between 1990-1994. The aerial data of 1990 and the map of 1994 show that the Bankimuhan nala discharges effluents to the sea without treatment. Moreover, along the road from Swargadwara to Baliapanda housing scheme many new effluent discharge points (drains not in the master plan or constructed after planning) are noticed through the 1990 aerial data and the map of 1994. These surveys also show solid waste dumping sites along the Bankimuhan nala and land filling along the sewerage channel zone by slum dwellers.

Puri is a showcase in coastal mismanagement. The way in which the CRZ has been breached and consequently the environment, is enough evidence of the government's utter unconcern towards the preservation and protection of the coastal ecosystem.

URBAN SPRAWAL MAP OF PURI



Source - Mr. D.Mishra & others Paper, CZIS Workshop, 1994, ORSAC, Bhubaneswar.

Clearance of forests near the coast affects body during cyclones and causes heavy loss of life and property.



Pix : Project Swaraj**ya**, Cuttack.

A number of Beach Resort/Hotel complexes coming up on the beach near Gopalpur, Puri, Konark, Chandbali, Paradeep etc. On the Puri-Konark marine drive was opposed to vehemently by environmentalists and politicians. It was observed that Land reclamation/construction activity is continuing within 200 mts. (land adjacent to Mangala nala, the extreme boundary of master plan area), these were previously under tree cover/ plantation on the Puri Coast. Also, large scale land subdivision/plotted development is continuing in the Sipasurbali and Baliapanda area within 200 mt. zone. In another case, an industry has come up in the 200 mt. zone. Such developments are seen in other areas also.

PROTEST AGAINST LUXURY BEACH RESORT

Obviously unchastened by the Chilika experience, the state government, in all ill-advised move, submitted to the Centre a Rs.862.15 crore plan for creation of a tourist resort complete with all modern amenities that go with a modern, upmarket beach resort including an 18-hole golf course on the Konark-Puri marine drive.

Nothing wrong with this grand plan to develop one of the best naturally gifted beaches in this country. Except that the 2,227 acres of land needed for the project is protected reserve forest with the 71.72 km Konark-Balukhanda sanctuary, home to a variety of fauna including at least two endangered species, to boot.

The proposed area had 5,17,778 trees, most, if not all, of which will have to be felled to make way for the beach resort. The trees, ecologists said, provided an effective guard against shifting a mounds of dunes apart from protecting the area from the harmful effects of tidal waves. The severe cyclone in 1972 which claimed thousands of human lives and cattle heads was preferred as an evidence to buttress the point. the presence of the Konark-Balukhanda sanctuary inhabited by a variety of wildlife including the black buck and monitor lizard, classified as Schedule-I animals under the Wildlife (Protection) Act, 1972, has made the state government's case weaker.

Former minister and president of the Orissa krushak Mahasangha, Banka Behari Das, who has come to be known as an environmentalist after his successful campaign against the prawn culture project at TATAs in Chilika, was the first to raise the issue. At a press conference in August, he blasted the state government for its ludicrous plan to provide pleasure grounds for rich foreign tourists at a heavy cost to the coastal environment and marine ecology.

As local newspapers picked up the lead, politicians joined the fray. In a letter addressed to Prime Minister Narasimha Rao, 11 members of Parliament cutting across party lines pleaded against central clearance to the proposal. The signatories included Yashwant Sinha, Kamal Morarka, Chitta Basu, Sanjay Singh and Srikant Jena.



Pix : Ghani Zaman for CPSW.

The strong lobby for land on the beach or occupation by any means will have a lot of adverse ecological impact.

Tourism department sources, however, allay all apprehensions of the ecologists. They maintain that adequate safeguards have been provided to prevent any hazard to the environment. They refer to the provisions of the Coastal Zone Regulation Act, according to which the built-up area cannot exceed 33.5 per cent of the total area. Even within the constructed area, 35 per cent has to be earmarked for plantation. They also point out that only eight sq.km. of the 71.72 sq.km. sanctuary comes under the purview of the plan which would not affect wildlife. In an effort to prove their contention, they quote the letter of the Principal Chief Conservator of forests (Wildlife) which says that existing animals in the area can be rehabilitated in the remaining 63 sq.km. of the sanctuary "if the proposed diversion of area is acceded by the government of India".



However, a letter (No.7777) written by the principal Chief Conservator of forests to the secretary, forests and environment, on May 3,1993 made it abundantly clear that there was something fishy about the goings on. The letter emphatically repudiated the divisional forest officer's calculations, incorporated in the proposal, about the possible loss due to felling of trees (Rs.10.37 lakh per year) and non-timber forest products (Rs.1.8 crore) as gross underestimation and warned against "killing the goose that lays golden eggs"

If doubts have persisted despite all the laboured clarifications, it is mainly because of two reasons. First, the ambiguous status of the land in question. While the draft proposal submitted to the centre leaves no room for confusion by stating that the land was protected reserve forests, officials, in an obvious act of afterthought, now maintain that it was anabadi revenue land which had been handed over to the forest department for plantation.

However, it is learnt that no decision has yet been taken on the status of the land. The forests and environment ministry, on its part, has classified the area as CRZ-I under the Coastal Zone Regulation Act taking into account the forests, which were created in the fifties to guard against high tides and cyclone and the presence of the wildlife sanctuary. Under the provisions of the Act, no construction whatsoever is permissible on CRZ-I category land. What the state government has in effect proposed is its inclusion in CRZ-III on which limited construction is allowed. But the catch is that such a change would not alter the ground realities. The CRZ-I label is assigned to an area because of its ecological sensitivity. Any change in the category would fail to ward off the threat to the environment of the coast.

Fortunately, the Union Ministry of Forests and Environment returned the draft proposal to the state government in December, 1993. Expressing serious reservation about some of the points in the draft proposal, it asked for a revised proposal. The state government is yet to comply. More recently, the Supreme Court, acting on a petition filed by Dr.Dinabandhu Sahu, ruled that the trees along the coast cannot be cut.

The Orissa government's contention that the proposed beach resort would bring in valuable foreign exchange besides giving direct or indirect employment to thousands of people falls flat on the face when its environmental costs are taken into account. This can be well judged from the current status of a large number of Hotels in Puri making huge losses. For one thing, it would expose the entire area to the risk of high tides which can do incalculable harm. For another, the threat of submergence of the beach due to global warming leading to a rise in the sea level is always lurking round the corner. In interest of the highly fragile coastal ecology, it is imperative that the plan be scrapped altogether.

In one such meeting, about 2000 people solemnly vowed that they would hug the trees till the last drop of blood oozes out of their body, it is government goes ahead with the felling of trees. Shades of another Chipko movement perhaps !.

WILDLIFE CONSERVATION

Of the 3,50,000 plants and 1,250,000 animal species, inhabiting the earth, India accounts for a rich diversity of 45,000 plant and 76,000 animal spices. This includes 500 species of mammals, 1200 species of birds, 700 species of reptiles, 250 species of amphibians and 50,000 species of insects. It is widely agreed, that this wealth of bio-diversity, is more evident in the eastern region of India, of which Orissa is an important part.

Without exception, Orissa has many endangered species. A brief look at some of these species, reveals where they stand and what hope is there for them, with ongoing conservation efforts.

ANTELOPES

According to the 1980 wildlife census of Antelopes, there were 485 of them in isolated pockets of Orissa in Ganjam and Puri districts. Places like Balipadar, Bhetani, Remuda, and Aska of Ganjam district and the borders of Chilika, Konark and Balukhand in Puri district are the preserves of the animal. The species is noted as endangered under the Wildlife Protection Act of 1972. Yet it took almost 12 years for the Orissa government to wake up and declare Black buck game reserves at Naranpur Remunda of Ganjam district.

Yet neglect and apathy of forest officials has led to the gradual decline of the antelope. While once wildlife officials had counted heads of 30 to 50 in 29 villages, today the herds have dwindled to 15's and 20's. Over the years, the Antelope has become game to predators. It is reported that in one year as many as 15 were killed in Aska alone. With the dwindling of grassland pasture in the reserve, the antelopes are forced to move to nearby hillocks for grazing, where they become easy targets for poachers. Of the 10,000 Black Bucks in India in 1980, Orissa accounted for 485, yet with the progressive decline of the species, nothing less than outright extinction is predicted.

Sea turtle preservation and conservation centre, Ekakula, Rajnagar.



Pix : Sanjay K. Khatua.

TIGER RESERVES

The royal tiger, another endangered species, is fortunate to have a home in Orissa. In the heat of the Northern Plateau region, lies one of the most rich biospheres of Orissa, the Similipal Tiger Reserve. The state government created a National Park division here in 1957 and years later launched the Similipal Tiger Project, in 1973. Happily, the Tiger Project has achieved positive results since its inception, with the approach of the conservation of the total ecosystem.

The White Safari : It can be said with pride, that Orissa owns the largest number of the rare species of white tigers in the world. Established in 1991 over 30 acres of land and with an investment of 32 lakhs, the white safari at Nandankanan, 16 Kms. away from Bhubaneswar, has 25 white tigers, including 9 cubs. Six have been given to other zoos, at home and abroad. Nandankanan has the distinction of evolving a new strain of white tiger, different from the famous "Rewa" white tigers.

CHANDAKA ELEPHANT RESERVE

In ancient India and even in the recent past, elephants have been useful for a number of purposes. But today, it is hunted down mercilessly and clandestinely, as a quick way to get rich. Tuskers are the targets of most of the game hunters and poachers and therefore their number has been steadily decreasing. Besides, deforestation (that is destruction of their natural habitat), has brought in a crisis of survival for elephants. Against such a background, the Chandaka Elephant Reserve, the first of its kind in India, is a welcome effort.

Created over an area 189 sq.kms and established with a fund of 5.08 crores, the reserve envisages closing of the area by deep trenches, electric fences, with provision of fodder and water resources, not only for the 56 elephants, but also all kinds of smaller wildlife. A wildlife division in control of the Department of Science & Technology and Environment has undertaken this project.

In May 27-30, 1991, the population of the elephants stood at 94. This included 53 females, 14 tuskers, and 26 baby elephants. Along with the elephant in the Badarama Sanctuary Sambalpur, Similipal and Satakosia, the total number of elephants in the state is 2000 The number is great, considering the relative population of the past years. Dead or alive, the elephant is of great value to man, calling for its immediate and imminent protection.

CROCODILE PROJECTS

The world has witnessed a catastrophic decline of crocodiles, as they become prey to hide hunters. Besides, the loss of sand banks that serve as basking grounds for crocodiles has led to their gradual decrease. In spite of such adverse conditions, Orissa is the only state in the country where all the Indian crocodiles species, namely the Gharial (Garialis gangeticus), saltwater crocodile (crocodylus poros) and Mugger crocodiles (crocodile palustris) are found. Orissa pioneered their conservation through various reserves at Tikarpada in Dhenkanal district, Dangamal in Cuttack district and at Nandankanan, near Bhubaneswar, as early as 1975-76.

Gharial Research and Conservation Project, Tikarapada : The Gharial Research and Conservation Project was established in April 1975 at Tikarapada, in Dhenkanal district. This is the first conservation project of its kind in the whole world. Due to indiscriminate killing of these reptiles and habitat loss, the population of Gharial was reduced to only five in the protected areas of the gorge. After collecting eggs from nature, these were incubated in the project hatchery, by simulating natural conditions and then young ones reared in rearing pools, by providing sound husbandry conditions, these young crocodiles built up the depleted stocks.

In the beginning eggs were not found in the Satakosia Gorge due to want of breeding populations. So eggs were collected from Gandak river of Bihar in the year 1975 and subsequently, eggs were brought from the Chambal river of U.P. and the Narayani river of Nepal and these eggs were incubated at Tikarapada, in the project hatchery. The hatchlings hatched from the eggs are being reared in the rearing pools at Tikarapada project with much care and precaution.

550 captive reared gharials have been released into the Satakosia Gorge and there is a proposal to release a few more gharials into the wild. Due to rigid protection of the gharial habitat, mainly in the gorge portions, a female gharial has been laying fertile eggs in the gorge since 1984. It is a great achievement for this decade long conservation effort. Accordingly census of the population of gharials in the river Mahanadi was taken up during the winter months of 1987-88, to know the status of the released and resident gharials in the River Mahanadi. Only 25 gharials were encountered, which signals a success or survival of 4.5% in nature.

Saltwater Crocodile Project, Bhitarkanika : The Saltwater Research and Conservation Project established in July, 1975 at Dangamal, in the midst of Bhitarkanika Wildlife Sanctuary, is situated at the river delta estuary of Brahmani- Baitarani in Cuttack district. This is one of the best saltwater crocodile conservation projects in India and one of the few such projects, in the whole world. (Details explained earlier).

The Crocodile is not completely safe, due to the shrinkage of habitat forest areas. It has been proved that the loss of mangrove forests, would mean the extinction of the C.porous population completely.

Ramtirtha Mugger Crocodile Project, Jashipur : The Mugger conservation centre at Ramtirtha in Jashipur was established in 1979, with grow and release technique. This was established with 24 muggers, which were brought from Sathanur Dam Sanctuary of Tamilnadu in March 79. The hatching was of the size of around 42-48 cms long weighing 300 to 500 grams in the tenth month. They were kept in hatchling pools. Even after a year of successful management, the mortality rate was as high as 33%. By the end of December 1980-81 more crocodiles of the age group of 4 to 5 years were brought from Madras crocodile Bank and Madras Snake Park and reared in an artificial medium, to acclimatise them to the colder temperature of the Similipal Hills.

These crocodiles have already been bred in captivity since 1984. The resultant hatchlings are being reared in the pools at the project.

By 1990 more than 159 young mugger crocodiles were released into the West Deo and Budhabalanga rivers, inside the Similipal National Park. This is quite a successful project in rearing and rehabilitating the muggers, into the wild.

Captive Breeding Project, Nandankanan Biological Park : The captive breeding programme of three crocodilian species have made tremendous progress since 1980. The captive breeding of gharials at Nandankanan Biological park is a record for our country as well as for the whole world.

In January, 1980 one large adult male Gharial obtained from Frankfurt zoo, West Germany was introduced into the specially designed breeding enclosure. The resident male Gharial of the pool was a defective one and was incapable of breeding. Mating was observed during the breeding season. A clutch of 25 eggs was laid in March 1980. This was the first time in the world, a female Gharial laid fertile eggs in captivity. In the subsequent years, the breeding programme progressed successfully. At present five out of six female Gharials accommodated in the breeding pool, have been laying eggs in captivity. The Hatching is quite satisfactory and the hatched ones are being reared in the pool.

In 1992, winter season 194 young Gharials of 2-3 years age group were released into the Satakosia Gorge of the river Mahanadi and some more are to be released in the following years. At present, 6 females and one male adult Gharials are being accommodated in the breeding enclosure. In addition to this 224 hatchlings, yearlings and juvenile gharials are being reared in the rearing pools at the park. Now Nandankanan boasts of 38 Mugger crocodiles including 5 adults, which are accommodated in various pools.

The captive breeding programme of saltwater crocodiles, was taken up in the year 1983, after a male crocodile was obtained from Kukrail (U.P) and was released in the breeding pool along with a lone female. Breeding didn't commence in the same year, but in subsequent years, she has been laying fertile eggs.

SEA TURTLES

Sea Turtles are slowly becoming an endangered species. Orissa harbours about 11 species (both fresh water and marine), of which perhaps 3 can be regarded as common. Very little is known about the turtles in Orissa and a detailed survey is necessary to know the distribution status of the turtles of Orissa. There are two marine turtles on the sea coasts of the state. One of them, the Olive Ridley Sea Turtle comes to several sea beaches of the state, for nesting. One of the important beaches is "Gahiramath" in the Bhitarkanika wild life sanctuary, where mass nesting of the Olive Ridley occurs, almost every year. There are several other sea beaches (Puri-Balukhand, Konark-Chandrabhaga, Chilka, Chandipur and Deviriver mouth), where there are reports of occasional nesting of the Olive Ridley. The state forest department has been taking various protection measures at Gharimatha rookery for safe nesting of the Olive Ridley.

AQUATIC ECOSYSTEMS AND BIODIVERSITY

UNINHABITED CHILIKA

Uninhabited Chilika is Unimaginable. Yet this rich natural habitat for both fresh water and brackish water species is becoming a death trap for the most prized species, among which are prawns and mullets. Changes in bathymetry, horizontal salinity gradient and weed coverage of the waterspread area of the lagoon at the rate of 14.6 sq.km. per year have made comfortable the dominance of autochthonus and forage fish fauna over prawns, mullets and other economic varieties. Uneconomic species like Thrissodes annandalei, Eatroplus, Suratemis, small prawns; freshwater carps, featherbacks, and minnows are slowly becoming the dominant species of lagoon and thereby changing its ecological condition.

The physical feature of the lagoon is itself being altered by rapid siltation and weed infestation which have destroyed 40% of the fishing grounds (Janos). Illegal encroaching of the Janos and other low-lying area of the lagoon through the erection of mud walls and enclosures have had an adverse ecological impact on it by cutting off the area from the lagoon ecosystem and disallowing it to function as a nursery for many aquatic organism. Above all, the encroaching of the Janos has already caused conflicts between the prawn farmers and the traditional fishermen of the lagoon.

Restoration of the original condition of the lagoon is an urgent, though not so easy a task. Siltation and weed infestation must first be removed. And then economic varieties of fish like Mugil cephalus, Liza troschelli, P.monodun, P.indious & Syclla Sarrate must be restored by legally allowing the embanking of the shallow inter submerged fringed areas of the lagoon where capture fishery and prawn farming could be practised. The preservation thus of this Natural Heritage of Orissa would be a tribute to the world.

The preservation of aquatic biodiversity is intrinsically related to the quality of the water in which they exist. But this quality is gradually being altered through siltation, eutrophication and pollution which are the triune dangers facing aquatic biodiversity. Siltation occurs when flood water wash down loose soil that easily erodes and carry it to the waterways as silt. A continuity of this process leads to the reduction in the depth of water bodies, closing of estuarine and lagoon months into the ocean, checking of vital interaction between the sea and inland water and sometimes the complete burial of all bottom vegetation along with the rich life that inhabits such green beds.

Eutrophication is caused by the discharge of domestic and community sewage from urban and rural slums into the lakes and tank beds around which they congregate. Eutrophication not only chokes the lake surface, prevents sunlight from penetrating the bed but also depletes the dissolved oxygen content of water creating a serious problem of biological oxygen demand (B.O.D) which severely affect the sustenance of all life in the waters.

In spite of being an universal solvent, trade effluents both organic and inorganic that come from industries or agricultural fields, aquacultural ponds or domestic and municipal sewage without treatment stagnate, pollute and deplete oxygen in the water thereby posing a great danger to aquatic life. Discharge of heavy metals, pesticides and radioactive wastes are even worse polluting elements that get bio-accumulated in a cumulative way and then pass on through the food chain to human beings causing numerous health hazards.

Apart from this, construction of dams or barrages across flowing waterways act as barriers for migrating fish and prawns preventing access to their habitual breeding, feeding and growing grounds. This may result in permanent and irrecoverable reduction in fish stock and even extermination of fish from such river systems (CBD 14 a). Some species like the Mahseer (Tor sp.) and the major carps have to migrate downstream but others like the Indian Shad (Hilsa illisha) migrate upstream for spawning but barricades like anicuts and dams across this route curb their reproductive potential thus exterminating the species. Jhingram (1991) recommends that fish ways and fish lifts be constructed across anicuts to enable free movement of fish and prawn. It is observed that the juveniles of the giant Freshwater Prawn (Macrobrachium Malcolmsini and M.Scabcriculum) crawl across the 1.5 meters high vertical sills and sluice shutters of the Jobra Anicut near Cuttack on the river Mahanadi and get over to the other side for growing (Raman 1977). Engineering designs must take these basic biological surges into account for saving aquatic biodiversity.

Destructive fishing practices can also severely affect aquatic bio-diversity. Bottom trawling nets have a fine meshed cod end which indiscriminately traps all marine life including even eggs and young ones. This destroys natural food chains and fishery potential on long term basis while simultaneously damaging the bottom habitat, submerging bottom vegetation and leveling all crevices and shelters for fish and other marine organisms. Purse-seining too damages marine life indiscriminately but only at the surface, netting huge shoals of fish, including breeders.

Commerce in marine resources is another threat to aquatic life. Seaweeds, grasses and algae which are the food of rare species like sea turtles and dugons are harvested for the manufacture of agar-agar ultimately leading to the decimation of the species. Similarly large quantities of colorful fish and shells from the Andamans and the Gulf of Mannar are either sold locally or exported resulting in the destruction of marine living resources. Another danger is the import of alien and exotic aquarium species. This may bring in the deadly viral infection called Epizootic Ulcerating disease syndrome (EUS) almost equivalent to AIDS among fishes. The infection has already reached every state of India through import of fishes from Bangladesh.

Protection and promotion of bio-diversity is therefore the need of the hour. As far as aquatic life is concerned, regulation of aquaculture and prevention of pollution of waterways is a must. Moreover, usage of appropriate gear, their mesh-size, fishing zones and fishing seasons must be prescribed so as to prevent capture of breeders. Even if breeders are caught they are to be mandatorily released back into the water by fishermen. A very practical step would be to provide fishermen with Sea Surface temperature (SST) charts so that they could save time and fuel in seeking potential fishing zones (PFZ). Fishing by use of dupes or poison whether natural or artificial and fishing by dynamite blasting should be prohibited. Moreover the magnitude of exports must be regulated so that it does not go beyond its maximum sustainable yields (MSY). Endemic species like the Tiger Prawn *(P.Monodon)* and the mud crab *(Cylla Serrata)* should be declared as "endangered species and their stock replenished by constituting project Tiger-Prawn and project 'Mud-crab' since these are being fast depleted because of excessive exports. Legislation should be made to see that only cultured stocks of these species are exported.

Above all legislation for the protection and promotion of Biodiversity must be made. The Wildlife (Protection) Act 1974 and the Water (Protection and Control of Pollution) Act 1974 and the Environment (protection) Act, 1986, do not take into account the biodiverse species which exist in them and are therefore inadequate to deal with the protection of biodiversity. It is a simple and clear fact that the protection of the environment bereft of its inhabiting life is incomplete. Water, air, land and space are not the only elements that need protection but also the complex ecosystems that they constitute, their biodiversity, inclusive of human life and much more the indigenous people who are closer to such ecosystems and their human rights that need to be protected in an integrated manner.

Rajnagar-Talcher Jetty : If Jetty construction takes place, Bhitarkanika ecosystem will be adversely affected.



Pix : Sanjay K. Khatua.

So far, there has not been any attempt for conservation of freshwater turtles of the state. However, 4 fresh water turtles and 2 sea turtles have been included in Schedule-IV of C.I.T.E.S. Further more, Schedule-IV of CITES requires capture permits for all the turtles of the family including Trionychid, of which 5 species are found in Orissa.

Extensive rookeries of the sea-turtles are found in Gahirmatha seacoast in Cuttack district and Puri-Konark sea coast. This is a renewable natural resource of the state, which has not been scientifically exploited. Investigating productivity and ecological parameters, such as natural predation and devising methods to prevent losses of turtles, are necessary, so that this species can be protected.

The conservation of sea Turtles is of international concern. It is these creatures which keeps the sea free from pollution and maintains the balance of the sea environment. It has been observed, that areas where the number of tortoises decrease and Jellyfish increase, is detrimental to the survival of fishes and therefore, to fishing itself. Increased coastal development by man, mechanized fishing techniques, deposition of debris in the sea and several other man-made factor, have contributed to the death of many species of aquatic life.

On 23rd September, 1988, the largest leather back sea turtle was found dead. It weighed around 2016 pounds (916 kg). The turtle had died due to drowning. Strange but true, this animal was found to have been strangled by a piece of plastic (15x25 cm), which had blocked the entrance to the small intestine.

Clearly man is to blame for what is happening to the seaturtles and ultimately to environment of the blues. The conservation of the small creature is therefore an absolute necessity.

AVI FAUNA

It is heartening to note that Avi-fauna in the Chilika region is increasing. According to experts, the white eyed swan numbered 12,120 in 1986, 14,011, in 1987 and 16, 100 in 1988. Era birds also amounted to 2553 in 1986 and increased to 3,560 in 1988. Other small birds like the Ghantula increased from 12,490 in 1986 to 16,600 in 1987. This general trend of increase is seen among all the 150 species sighted in Chilika, of which 97 migrate to India from abroad. The total number of these birds in 1986 was 3,320 & two years later it amounted to 8,200, a very significant increase.

However, this is not the case with many other birds throughout Orissa which are just vanishing. Such birds are the Great Crested Gable, White Stork, Brahminy Kite, Black Vulture, Great Indian Bustard etc. Nothing much has been done so far to preserve Orissa's avi-fauna except in terms of creating and establishing wildlife sanctuaries and parks which are its natural habitat.

REPTILES/LIZARDS

The state is rich in their numbers though their distributional status is unknown. In such a state of affairs it is not surprising that they have been given little or no attention at all, in terms of conservation measures. The lizard is no exception. Dutta and Acharya have found 19 species of lizard in Orissa. Of these only 9-varinds and the Indian Chamelion have been protected by the Wildlife (protection) Act, 1972. The major habitat of the varinda, the Indian monitor lizard, is the Bhitarkanika Wildlife Sanctuary and it is kept under the strict vigilance of the State Forest Development (Wildlife Wing). Much needs to be done for the reptiles.

Conservation of wildlife by human strategies are undoubtedly a very difficult and delicate task. That Orissa has met with success in its experiment of the conservation of white tigers and crocodiles is something noteworthy. However, the best method of conservation is without question, uninhibited growth of wildlife in a natural widerness. And it is with regard to this, that the Orissa Government has attempted to create a National Parks and Sanctuary (Homes exclusively for wildlife), so that the flora and fauna live in harmony and interdependence.



Pix : Eastern Press Agency, Bhubaneswar.

The 17 reptile animal, we always see and encounter.

ZOOLOGICAL & DEER PARKS

At present there is a State Biological Park at Nandankanan consisting of a Zoological Park and Botanical Gardens. Besides, there are deer parks at Raj Bhavan (Bhubaneswar), Sunabeda (Bolangir), Kapilash (Dhenkanal), Chandipur (Balasore), Sunabeda (Koraput), Kuanria (Puri) Cuttack and at Rourkela.

The Nandankanan Biological Park is attracting more than 10(ten) lakh visitors a year. These parks serve the good cause of creating awareness among the public about the conservation of wildlife.

Table - 7 INFORMATION ON NATIONAL PARKS & SANCTUARIES IN THE STATE OF ORISSA AS ON 1ST APRIL, 1990

Sl. No.	National Sl.No.of Sanctuaries	Name of National Park/Sanctuary	Name of Forest	Name of the District Division	Year of Estt.	Notification No.& Date	Area in Sq.Kms	Important Flora & Fauna
01.		North Similipal (Proposed)	Baripada & Karanjia	Mayurbhanj	1980	1870 & 6727/FFAH dt.6.8.80 dt.30/4/1.5.85	845.70	- Cheetal,Leopard,Mouse Deer,Tiger,Elephant Gour,Sambar,Mugger,Ratel,Malabar,Giant, Squirrel,Hill mynah,Crested serpent,eagle, Pea, fowl,python,piasal,champa, Asan,Tree, ferns,orchids.
02.		Bhitarkanika (Proposed)	Chandabali	Cuttack, Balasore	1988	22904 dt.30.10.88	367.00 1212.00	- Water monitor lizard,king cobra,cobra, fishing cat,pointed sterk,king fishers, open billed sterks,darter,cormorants, crabs,fishes & mud swippers etc.
SANCTUARIES								
01.		Bhitarkanika	Chandabali	Cuttack Balasore	1975	6958 dt.22.4.75	170	- Salt water crocodile,blackbuck,spotted deer,porcupine,wild boar,various types birds, Bani,Sundari,Keruan,Rouna, Rai,and other aquatic flora & vegetation
02.	95	Balukhanda Konark	Puri	Puri	1984 & 1987	9012 dt.23.4.84 15216 dt.1.9.87	71.72	Flora - Polanga, Eucalyptus, Neem etc.
03.		Nalaban Chilika	Puri	Puri	1973 & 1987	23403 dt.17.12.87	15.53	About 150 species of birds (resident and migratory)like flamingo,bareheaded geese, greylag geese,cormorants,darter,sea gulls,
04.	96	Chandaka Dampara	Chandaka (Excluding mining area of 17.6 sqkm)	Puri	1982	Final Notification yet to be issued. 35500 dt.21.12.82	175.79	- Elephant,cheetals,sambars,mouse deer, leopard,wild dogs,ratel,jackets,pea fowls Red-jungle fowls etc.Tangan,Mai,Gambhari, Bamboos and Canes
05.	97	Dabrigarh	Sambalpur	Sambalpur	1985	2409 dt.8.2.85	346.91	- Leopard,Deers, Sambar,Chausingha, Wild boar and pea fowl, baja,sal,asan,karla,dhaura.
06.		Hadgarh	Keonjhar Baripada	Mayurbhanj Keonjhar	1978	34113 dt.6.12.78	191.6	- Elephant,wild dog,panther,leopard, cheetal,barking deer.
07.		Kotgarh	Balliguda	Phulbani	1981	30253 dt.3.12.81	399.5	- Tiger,Leopard,Chausingha,Elephant,Sambar, spotted deer,Neelgai - Sal, Bija, Bamboo,Asan, Sidha
08.	98	Kalahandi	Rairakhol	Sambalpur	1982	584 dt.7.1.82	116.00	- Leopard,Sambar,barking deer,peafowl, spotted deer,tiger,elephant, gaur - Sal,bija,bamboo
09.	...	Kuldiha	Baripada	Balasore	1984	243 dt.4.1.84	273.75	
10.		Lakheri Valley	Paralakhemundi	Ganjam	1985	28333 dt.8.2.85	185.87	- Elephant,spotted deer,wild boar,sambar, barking deer,peafowl - Sal,piasal,bamboo, teak.
11.	99	Mahanadi Baisipali	Nayagarh Baudh	Puri Phulbani	1979	25335 dt.6-7.11.81	168.35	- Elephant,spotted deer,tiger,leopard barking deer,sambar,bear - Sal,karada,piasal,kurum,asan,bamboo
12.		Nandankanan	W.L.Co.	Puri	1979	20672 dt.3.8.79	14.2	- Sambar,spotted deer,monkey,including zoo animals - Terminalia, Arjuna,adina cardifolia, bridelia, retusa,kasi,kusum
13.	102	Similipal	Baripada & Karanjia	Mayurbhanj	1979	3046 dt.3.12.79	2200	- Elephant,tiger,sambar,deer,leopard,mouse deer,crocodile (mugger) - Teak, sal,sisoo,bamboo
14.		Sathosia gorge	Nayagarh Boudh Angul	Puri, & Phulbani, & Dhenkanal	1976	22727 dt.19.5.76	795.52	- Mugger & Gharial crocodile,elephant hyena deer,sambar,barking deer,bison,percupine and bears - Sal, karada, dharw,piasal,sisoo,teak, asan and bamboo
15.		Sunabeda	Khariar	Kalahandi	1988	10772 dt.10.5.88	600.00	- Tiger,bison,panther,chital,leopard, barking deer,nilgai,sambar - Sal,piasal,asana,siali climber
16.	103	Ushakothi	Badrama Sambalpur	Sambalpur	1987	23393 dt.17.12.87	304.03	- Tiger, leopard,elephant,panther,bison - Sal,bija,sisoo, gambhari,bamboo

Total Forest Area (1989-90) = 59,555
Percentage of sanctuary area = 10.12%

PROPOSED SANCTUARY

1 ...	Karlapat	Kalahandi	Kalahandi			255.00
2. ...	Kond-Kamberu	Jeypore	Koraput	...		430.00
3. ...	Balimela	Jeypore	Koraput			160.00
4. ...	Naarayanpatna	Rayagada	Koraput		...	429.86
5. ...	Gahirmatha Marine	Chandabali	Balasore, Cuttack	...	...	566.76

WILDLIFE MANAGEMENT

Conservation must go hand in hand with effective management. The necessity of planning, organisation and control in wildlife management, is imperative to achieve results. Therefore, the wildlife action plan consists of constitution of Advisory Boards, Education, Research, Training and even the actual cooperation of the people, in the drive towards conservation.

The National Wild Life Action Plan

1. The establishment of a network of protected areas such as national parks, sanctuaries and biosphere reserves, to cover representative samples of all major wildlife ecosystems and with adequate geographic distribution.

2. The restoration of degraded habitats to their natural state within these protected areas.

3. The rehabilitation of endangered and threatened species and their restoration to protected portions of their former habitats, in a manner which provides some reflection of their original distribution.

4. The provision of adequate protection to wildlife in multiple use areas (such as production forests and pasture lands) so as to form "Corridors" linking up the protected areas and providing for genetic continuity between them.

5. Support for the management of botanical and zoological parks and gardens and undertaking captive breeding programmes for threatened species of plants and animals.

6. The development of appropriate management systems for protected areas, including a professional cadre of personnel fully trained in all aspects of wildlife and sanctuary management, as well as the provision of proper orientation to all officers concerned with wildlife.

7. The development of research and monitoring facilities which will provide scientific understanding of wildlife populations and habitats essential to their proper management.

8. Support for wildlife education and interpretation aimed at a wider public appreciation of the importance of wildlife for human betterment.

9. The review and updating of statutory provisions, providing protection to wildlife and regulating all forms of trade, so as to ensure their current effectiveness.

10. Assistance in the formulation and adoption of a National Conservation Strategy for all living natural resources on the lines of the World Conservation Strategy launched in 1980.

11. Participation in international conventions designed to prevent the depletion of the wildlife resources and to provide protection to migratory species.

12. Long term conservation of wildlife based on the scientific principles of evolution and genetics.

Constitution of Advisory Boards

There is a State Wildlife Advisory Board with the Minister of Forests, Orissa as its Chairman and Officials, and non-officials, as its members to advise on all wildlife matters of the state.

There is another board known as the Nandankanan Development Board with the Minister of Forests, Orissa as its Chairman and high officials as members, for the proper, quick and coordinated development of the Nandankanan Biological Park, consisting of the Zoological Park and Botanical Garden.

Wildlife Sanctuaries & National Parks : As discussed earlier, for proper management and protection of some of the important wildlife, sanctuaries have been established. At present there are 16 notified Wildlife Sanctuaries in the state for the conservation of important wildlife, a National Park namely Bhitarkanika has been notified. Above all, of greatest joy to environmentalists is the recent declaration of Similipal as a biosphere reserve.

Breeding of Endangered Species : Breeding of endangered species of wildlife is an important aspect of any wildlife conservation programme. Therefore, attempts are always made for breeding and propagation of endangered species in captivity at the Nandankanan Biological Park. The park has been successful in breeding some of the endangered species like tiger, white tiger, panther, black panther, leopard cat, golden cat, black buck, four horned antelope, Indian lion, Indian pangolin, Indian python, gharial, mugger and salt water crocodile, etc. After meeting the requirements of the park, some of these animals were also supplied to other Zoological Parks of the country.

Rehabilitation of Species : Rehabilitation of species in their natural habitat, where they were known to exist earlier, is one of the known methods of conservation. Rehabilitation of Gharial in its natural habitat, the river Mahanadi at the Satakosia Gorge Sanctuary, was done for the first time in the world, on 9th April 1977 and so far more than 200 young gharials, have already been rehabilitated in Orissa.

Similarly 125 young Estuarine crocodiles of Dangmal unit were released into their natural habitat, at the Bhitarkanika Sanctuary. So far, 60 mugger crocodiles have been rehabilitated in their natural habitat, in the river Budhabalang, in the Similipal forests (Mayurbhanj district).

Creation of a Separate Wildlife Wing : A separate wildlife wing within the State Forest Department was set up on 3rd June 1976, to save wildlife from rapid depletion and extinction, as well as to check denudation of the habitat. The wing was headed by the Chief Wildlife Warden, Orissa, initially in the rank of Conservator of Forests. But at present, it is headed by an Addl.Chief Conservator of Forests (Wildlife) with headquarters at Bhubaneswar. All the territorial and wildlife divisional forest Office and the Wildlife Conservation Officers of the State, have been appointed as Wildlife Wardens. Some of the eminent wildlifers of the state have also been declared Honorary Wildlife Wardens.

Another wildlife conservation division with headquarters at Chandbali (Balasore) has been created since 1980. One more division under the Deptt. of Science, Technology and Environment has been recently created, to manage the Chandaka Elephant Reserve. The staff of this wing would discharge the statutory functions laid down in the provisions under Wildlife (Protection) Act, 1972 and rules framed thereunder, in addition to scientific management and development of wildlife areas of the state.

Natural History Museum : The Natural History Section of Orissa State Museum, Bhubaneswar, which attracts large number of people every day, helps in creating interest among the public, about nature and wildlife conservation.

Research : Research on various aspects of wildlife and their habitat, is considered necessary, for the successful implementation of any wildlife conservation scheme. Research on various aspects of the tiger in their natural habitat and specially the study of the behaviour of the famous tigress "Khairi" of Similipal Tiger Reserve, is well known.

The first stage of research projects on Gharial and Salt-water crocodile have been completed. Two research scholars of the wildlife wing, have been awarded Ph.D.degrees by Utkal University, based on their research findings. A number of research papers on the findings of the crocodile project have already been published, in different reputed journals. A research project on birds of the state called 'Project Bihanga', is also being conducted by Mr.U.N.Dev, a well known Ornithologist.

The study of pathological conditions and diseases of wild animals and birds in captivity, is in progress, in collaboration with Orissa University of Agriculture and Technology and the State Animal Husbandry Department. Besides, the study on various aspects of different species of wildlife, maintained at the Nandankanan Biological Park, is in progress. Research papers on the findings of these studies, are regularly published in leading journals of the country and abroad.

Wildlife Census : Census of different species of wildlife is essential, to know the status of a species in a given area. Only then can an effective conservation programme be planned. For the first time in May, 1972, the census of the tiger, was taken up in the state and this revealed that there were 142 tigers. The second tiger census carried out in the state in May 1979, put the population at 173 tigers. This number increased to 203 in 1984. The census of black bucks of Bhetonoi in Ganjam district, was conducted twice in May 1973 and April 1980. As per these census there were 523 and 485 black bucks respectively.

Elephant census of Orissa was conducted for the first time in May 1979 and according to this census, there were 2044 elephants in our state. It is proposed to extend the census of wildlife to other species of the state and to conduct the census of different species of wildlife at regular intervals, to know their status, so that effective conservation schemes can be planned.

Control of Wildlife Diseases : Wild animals and birds like domestic livestock, suffer from various infectious and non-infectious diseases. At present there are two Veterinary (Nandankanan Biological Park and Similipal Tiger Reserve) and one Livestock Inspector, working in the Forest Deptt, for the control and treatment of wildlife diseases. Another veterinarian of the State Animal Husbandry Department, has also been posted at Nandankanan for the same purpose. The specialists of Orissa Veterinary College and State Animal Husbandry Department, render their valuable services, as and when required, for the control of diseases among captive and free living wildlife.

Publicity : Along with the rest of the country a wildlife week is celebrated in our state every year in the first week of October. During this week public attention is drawn through various media, like Radio, film shows, newspapers, magazines, pamphlets, essay competition among school children, meetings, etc, on the importance of wildlife in human welfare and the necessity for conservation.

The State Government Departments of Information and Public Relations has produced a few films on forests and wildlife like 'Nandankanan', 'Princess Khairi' 'Forest of Orissa' and 'Birds of Chilika Lake'. These Wildlife films are screened at different places of the state, at different times of the year, by the Forest Department and Information and Public Relations Department, for creating an awareness about wildlife among the public. At Nandankanan, wildlife films are screened on all holidays, for the benefit of the visitors visiting the parks. Posters, stickers, booklets and pamphlets are brought out frequently, depicting the various wildlife of the state.

Wildlife Education : It is gratifying to note that the Utkal University has started a specialized course on "Wildlife", at M.Sc.(Zoology) level, from the session 1978-79.

Similarly a course on "Diseases of Wildlife" is being offered to M.V.Sc. (Veterinary Medicine) students, of Orissa University of Agriculture and Technology, since 1976-77.

Besides, wildlife as a subject is taught to the trainees of the Forest Rangers' College, Forester and Forest Guards Schools, situated in the state.

The training of a few personnel of the country, was organised at Nandankanan, in collaboration with the Wildlife Institute of India.

Two Wildlife Wings provide all possible assistance to these courses.



Red horse shoe crab - is a rare animal in the Chandabali coast. The blood of which can cure serious diseases. There is an effort by Project Swarajya.

PEOPLE'S INVOLVEMENT

It is an accepted fact that no wildlife conservation measure can ever be successful without the whole hearted support of the public in general and rural masses in particular.

It is gratifying to note, that due to the sincere efforts of the villagers of Bhetnoi, near Balipadar in Ganjam district, a herd of Black Bucks are still surviving. The preservation of large turtles in Golia in Ganjam and at Maneswar in Sambalpur district are other examples. Indeed such examples of keen interest in wildlife conservation among people are rare. Recently in November 1984, a mass mobilization programme for conservation of Black Bucks of this area, was organised at Buguda (Ganjam district), to draw the attention of the public, both officials and non-officials, about the necessity of conservation of Black Bucks.

Since 1982 a society named as 'Nature and Wildlife Conservation Society of Orissa' has been formed, as per the suggestion of the State Wildlife Advisory Board. The main purpose of the society, is to involve people from all walks of life in conservation of nature and wildlife of the state. The society is holding symposia and film shows from time to time and bringing out a quarterly newsletter on nature and wildlife. There is a proposal to take up some specific wildlife projects independently.

Wildlife Animals and People : This aspect of wildlife conservation has not been taken seriously. The impact of people on conserved wildlife animals and vice versa, should be meticulously considered, for effective conservation. A modest estimate of the total sanctuary areas of Orissa reveals that at least 60 - 80,000 people inhabit the sanctuaries and immediately around the protected zones. They are of course prepared to face the challenges of the impact of wildlife, on them, although the trenches and electric fences which are planned for sanctuaries closer to urban areas (Chandaka near Bhubaneswar), are not planned for the remote areas.

It is an accepted fact, that the people living in coexistence with the wild beasts, do not perceive them to be a danger, as their urban, suburban or settled rural counterparts do. The age old sanskrit saying that "tiger eating man is an unavoidable rumour" (Byaghra Manushyam Khadati it Lokapabada durnibara) holds, when a sanctuary dweller describes the tiger and tigress as a gentle man and lady of the forest respectively. They have more practical knowledge about the habits and behaviour of their wild companions.

Non involvement of rural people equipped with traditional knowledge and skill in conservation is unfortunately a reality.

A team of concerned scholars spent more than a week in the Similipal national park and sanctuary area and found that the entire area of 2750 km^2 has about 75 villages (40 in Karanjia, 15 in Baripada and 20 in Udala Tehsils) with 10 in the original core and 25 in the extended core. The free moving animals which follow the streams and other marked routes of mobility, freely enter into these habitations, being an ever present danger to all 150 villages (110 in Karanjia and 20 each in Baripada and Udala Tehsils). The average population in the core being not more than 5000 (5/km^2), the project has a direct and indirect impact on 25-30 thousand people. Since the date of sanctuary declaration, the government has issued evacuation notices 3-4 times, without any enforcement. As per the views of foresters it is necessary because

i) There is danger to human settlements

ii) Poaching is facilitated by forest dwellers.

The tribals however are not found to be apprehensive of any danger to them. The foresters on the other hand, refer to a general poaching practice called 'Akhanda Shikara' (Non stop hunting). But investigation into this practice reveal that the Santhals of Bihar observe the first day of Vaisakhi (2nd week of April) as 'Aakhari Shikari' and go on mass hunting. The practice got its boost when the Rajas on Paridhi (Hunting) used masses of people. The place called 'Chahala', according to locals, got its name, when a king of Mayurbhanj killed so many animals on this spot, that he got a shock in his mind.

On discussion, people in the habitat said, that for killing wild animals, they don't need an occasion and if they really want to kill, no act or government officials can stop them. The record of arrests conducted by the police reveal, that they are outsiders. Taking this as a plea for evacuation, has set the people dead against the Govt. and they have submitted a written memoranda. A government proforma seeking information on the land, properties and compensation expected, remains a dead letter, as people refuse to fill it up, feeling insecure about the idea of leaving their place. Although the government has denotified some reserve forests for their settlement, people are not very convinced.

Tourism is a positive pressure on the Similipal. During 1980-81, 6018 tourist visited the area, while 15,045 came during 1988-89. The occasional poaching by tribals here, should be compared with poaching by the tourists and organized smugglers. Simultaneously the cultivation by tribals should also be compared, to the submergence, due to the proposed hydro projects at Barheipani and other large scale degradations, especially by migrants from outside Orissa. The choice between the impact of tribals on the reserve and that due to other forces, must be evaluated, as it is a choice between two sets of human beings.

This is more or less the story of all the sanctuaries. When newspaper reports regarding the killing of a tiger or a tusker some where in Mayurbhanj, Keonjhar, Phulbani or Sambalpur are published, we are able to visualize, that agents of the global ivory and tiger skin trade, are not only there in the urban areas, but have started establishing themselves in the villages within the core. Even if we evacuate the last family of a habitation from a sanctuary, we cannot deal with the traders agents, as the tentacles of their clandestine organisation, has spread into all control rooms.

Two universities of the state, have started offering wildlife courses (Theoretical). But the average school master still frightens the kids, with figures of tigers on paper. While an average parent has many erratic ideas on wild animals, students with honours in animal sciences, are often confused between a poisonous and non poisonous snake. Can we really come out of this dungeon ? Can we check gun licenses, that make money through tusker killing ?

Most of our elite are elated, when stories of wildlife conservation are told in the media. But very few of them bother to calculate the costs and the benefits. Wild animals are a renewable resource. In the books of forest statistics, we see the expenses made on the protection of wildlife, but not the additions to the state exchequer. Each sanctuary has a carrying capacity. Wild life records don't talk about it. There is no calculation of a target date, when the carrying capacity would be reached and the surplus animal biomass can be harvested for human benefit. There are no estimates of loss due to unauthorised killings and clandestine trade. Thus, although the efforts of wildlife conservation appear very attractive on the surface, with the infrastructure, manpower and publicity, the untold stories reveal something else, demanding the action of concerned citizens.

LEGAL PROVISONS FOR SANCTUARIES & NATIONAL PARKS

For the first time legal protection to wildlife was provided during the British period. The Indian Forest Act of 1865 and 1927 and their amendments provided considerable protection to wildlife by means of the systems of reserved and protected areas.

After independence the Constitution of India recognised the importance of protection of wildlife and included it in the "Directives of State Policy". Article 48 of Constitution reads that the State will endeavour to protect and improve the environment and to safeguard the forests and wildlife of the country. Again, article 51 A spells out that, "It shall be the duty of every citizen to protect and improve the natural environment including forests, lakes, rivers and wildlife, and to have compassion for living creatures".

However, the first uniform legal legislation for the protection of wildlife in the country was enacted and enforced in the year 1972. The Act is known as the Wildlife (Protection) Act, 1972. This Act became applicable in all the states except Jammu and Kashmir as it had a similar one for the same purpose. The Wildlife (Protection) Act, 1972 provides for the creation of wildlife sanctuaries and national parks and also specifies the management parameter by indicating the types of activities that are allowed or forbidden in such protected areas.

The Wildlife (Protection) Act, 1972 and the rules framed thereunder are in force in the State since 14th August, 1984. This will go a long way in the conservation of the wildlife of the state. The Act is being strictly implemented in the State, to prevent wildlife offences. As per this act, with the cooperation of the Railway Authorities, supply of sea turtles by train in Calcutta market from Puri-Konark coast has been totally stopped. Poaching of sea turtles from Gahirmatha coast of Bhitarkanika Sanctuary, could be checked, with the help of the Coast Guards. The Act provides that an area can be legally earmarked as a wildlife sanctuary with the notification by the state government,. according to section 18(1). Similarly, section 35 deals with the declaration, management and maintenance of national parks.

Further, the only procedure of proclamation as laid down by the Wildlife (Protection) Act, 1972 is through publication of the notification in regional language(s) in every town and village in or around the neighbourhood of notified area. More often than not, the non-literate inhabitants are not aware of such notices or stipulations, and so the proclamation remains out of reach. Sometimes, the areas may be so remote that the collector may not find it feasible to publicise the notice in such areas.

It initiates the process of rights acquisition by stipulating that within two months from the date of publication of the proclamation the "interested persons" shall have to prepare their claims and rights in writing. (Clause B of Sec.21) Sections 19,20,211(b), 22 and 25 of the Wildlife (Protection) Act, 1972 deal with the rights of the people within the limits of the sanctuaries. But nowhere does the Act define the exact meaning of these 'rights' and therefore the term 'rights' of person is subject to much ambiguity.

Even the traditional rights of collecting minor forest produce and other forest produce which are crucial for their sustenance are not recognised as"rights" under WPA, 1972. The Act does not provide any specific guidelines with regard to compensation, for the collector or any other official vested with the power and responsibility to settle the claims of the people.

These "Kelas" are the people skilled enough who can be used in wildlife conservation



Pix : Sanjay K. Khatua.

Restrictions and Prohibitions : The Act legally curtails the rights of free movement of the local people inside the sanctuary, and puts restrictions on inhabitants inside these areas. The Wildlife (Protection) Act minutely details out the type of person(s) who can legally enter and reside in the sanctuary for the specific purposes (See 28). The WPA thus does not provide any legal protection to the forest dwelling tribals with regard to their ancestral settlements.

The Act strictly prohibits any kind of destruction,exploitation or removal of wildlife and any activity causing damage to the habitat of any wild animal. This provides ample scope to the Government to put any restriction on the local people. Thus, the Act prohibits entry into the sanctuary with a weapon, effectively curbing the forest dwellers from carrying traditional tools like axe,bow and arrow etc. But what has direct and more serious implication for tribal life and economy is the restriction and sometimes prohibition of grazing and movement of livestock.

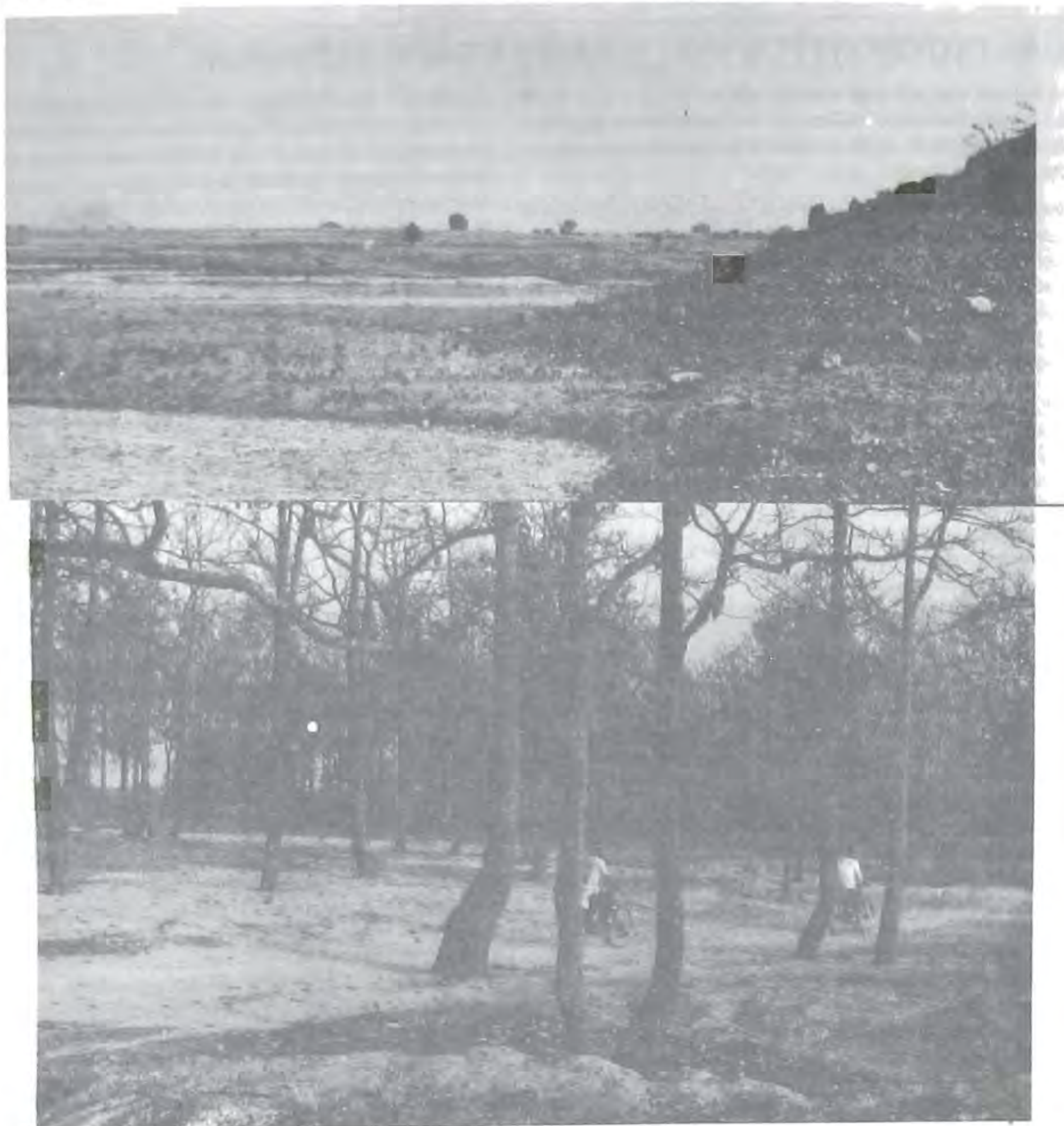
Wildlife Protection Amendment Act, 1991 : The Amendment Act, 1991 belied all the hopes of the people. Neither people's participation was considered nor their interest given priority. However, it does mention that individuals and NGOs must take an active role in the implementation of the Act. So the one role mooted out for the NGO's has been that of helping the officials in detecting offenses or contravention of the rules.

The Act vests immense power with the government agencies to protect wildlife and the natural eco-system and does not consider it necessary at all to involve the local people in the process of the constitution of a sanctuary or a national park or in their management. The Act plays a role of an alienating agent for the people who are dispossessed of their natural resource base. Besides the formation of sanctuaries and national parks, two other developments have further strengthened the process of alienation for the local people and these are the creation of biosphere reserves and the Project Tiger.

A POLICY & PERSPECTIVE

Hence, the important ethical questions that arise here are : Whose "interests" should be given priority ? Should the immediate survival needs of the marginalised and impoverished section be totally undermined to attain "absolute conservation" of wildlife, flora, fauna and natural eco-systems? Is the conservation strategy viable without taking into account people's survival needs and people's participation ? India has a long tradition of wildlife preservation. It dates back to the vedic period. The ancient Hindu scriptures directed people to protect their environment. Conservation of wildlife was embedded in the culture. Various caste groups had one or the other animal as the sacred symbol of their 'gotra'. And the members of those caste groups considered it their religious duty to protect these totemic animals. Even Buddhism and Jainism which emerged at a later stage in India, too, advocated protection of all jiva or living beings. 'Arthashastra', the statecraft manual written by Kautilya, sometime in the fourth century B.C. refers to 'Abhayaranyas' or forest sanctuaries.

Any conservation strategy must adopt a holistic approach. The focus of state sponsored conservation should not be confined to only flora and fauna or the bio-diversities, but include human beings too. The conservation perspective must take cognizance of the integrated and interdependent natural system, of which flora, fauna and human beings are integral constituents.



Pix : Sanjay K. Khatua.

Micro-climatic changes affect the rural life severely - a scene of Bongamunda area in Bolangir.

ATMOSPHERE

Global Warming and the green house effect which result from macro level changes in the atmosphere should be viewed with seriousness in Orissa. These phenomena threaten to submerge the fertile coastal plains causing social and economic upheavals besides bringing about climatic changes in the State. But of immediate concern should be the management of Orissa's microclimates. Orissa has a rainshadow area and a small coastline repeatedly ravaged by cyclones. A slight imbalance in the microclimates can result in severe floods, erratic rainfall, droughts and famine condition in parts of the state and rise in temperature. The scenario of a predominantly agricultural economy facing such climatic and the consequent food security problem is perturbing to think of. It is therefore imperative that deforestation, soil erosion, and developmental activities, especially industries and mining should be regulated so as to maintain the climatic balance. It is in this context that Orissa's atmosphere attains significance.

ORISSA'S ATMOSPHERE

Orissa's atmosphere is largely influenced by it's tropical location, proximity to the Bay of Bengal, winds, relief features, inland water bodies and vegetation cover. Situated between 17°N-23°N latitude, Orissa receives a varying amount of insolation ranging from 714-1104 Kw-hr/sq.km./decameter between March and December. The amount of heat received from the sun is of course determined by the angle of incidence, distance of sun and latitude position of the earth (see table - 1). Correspondingly Orissa's closeness to the Bay of Bengal casts a sobering effect on the coastal air, moderates its temperature and adds humidity to it, through the cycles of land and sea breeze. Thus these and other factors maintain the temperature of Orissa's atmosphere at 26°C near the coast which decrease only by 2°C in its highest elevations.

Table - 1 : Angles of Incidence of Sunlight and Solar Heat Input at various Latitudes of Orissa at various times of the Year.

Latitudes (°N)	Dec. 22 Angle of Incidence	Insolation	March 21 Angle of Incidence	Insolation	June 21 Angle of Incidence	Insolation	Sept. 23 Angle of Incidence	Insolation
17	49°30'	714	73	997	83°30'	1104	73	989
18	48°30'	710	72	992	84°30'	1098	72	984
19	47°30'	706	71	986	85°30'	1092	71	978
20	46°30'	702	70	980	86°30'	1085	70	972
21	45°30'	697	69	974	87°30'	1078	69	966
22	44°30'	693	68	967	88°30'	1071	68	959
23	43°30'	688	67	960	89°30'	1063	67	952

Source : Computed from the values at 20° N latitude using cosine functions.

Besides this, the Bay of Bengal becomes the centre of low pressure causing heavy rains and cyclones. These cyclones and depressions involve circulations over thousands of kilometers and are regional level links of Orissa's atmosphere but there are global circulations which links Orissa's air with the entire planetary circulations. This interaction of regional and planetary circulations cause the monsoons the most prominent feature of Orissa's climate.

WEATHER MECHANISM AND THE INDIAN MONSOON

Worldwide survey for long range prediction of the Indian monsoon rain depicts a close relationship between South America pressure and Indian monsoon rainfall. The relationship is a see-saw oscillation of pressures between equatorial low pressure system & the southern hemispheric subtropical high in a cycle of 2 to 2½ years which is the cyclic change over between westerlies and the easterlies. The southern oscillation is linked with changes in Peruvian & South equatorial ocean currents. The heavy rain in Peru is caused by increased convection, giving rise to heavy rain and release of latent heat in the rain fall maintains warm pool. The drought in the Africa-India-Australia region and rains in America is linked with changes occurring in atmospheric circulation induced by interrelated phenomenon called El Nino - Southern Oscillation (ENSO) phenomenon. The process is set up by reversal of southern oscillation with higher pressure to the south, followed by disruption of trade wind circulation, subsequently causing wind driven east ward migration of warm waters of west Pacific. The India-Australia region experiences drought and the normally dry mid Pacific area get heavy rain as the warm surface water moves east.

THE GLOBAL INFLUENCE

South West Monsoon Season : Wet Season or "Varsha" : Orissa's monsoon season extends from June to September and during this period, she receives almost 80% of the rainfall (annual). Monsoon is the seasonal reversal (Inter-Tropical Zone of Convergence) of the general planetary winds due to the north south shifting of ITCZ inspired by apparent movement of sun. It is a global phenomenon confined to summer and winter positions of equatorial low pressure though the seasonally reversed planetary winds carry humid air from adjoining seas to the land mass where they are obstructed by hills to rise-up or crawl over plateaus to cool and leading to condensation and precipitation.

The most developed nature of Asiatic monsoon is due to maximisation of land-water contrast. The east-west extent of the massive high rise Himalaya prevents summer monsoon to cross over to central Asian region and thus the gains are confined to Indian sub-continent. The free flow of North east monsoon is of course prevented by this barrier. But for the Himalayan grandeur, the deep low pressure over Pakistan would not have extended across the Indo Gangetic plain and consequently Orissa & the eastern region would have been debarred from getting monsoon bounties. The 4000 m. high and 4.5 million square kilometer spread Tibetan Plateau acts as a high heat source and is another important factor in shaping the monsoon over the Indian subcontinent as well as that of Orissa.

The outflow of cold dry north easterlies from central Asian regions towards the summer southern hemisphere carries moisture of Bay of Bengal to the Indian sub-continent and is called North east monsoon.

During summer a deep low pressure area develops over north Pakistan & high pressure area develops over South Indian Ocean. From April end the subtropical high belt of southern hemisphere shifts northward as sun apparently moves north and by June the Pakistan low becomes fully established and extended over the Indo-Gangetic plain up to the northern tip of Bay of Bengal. This east-west spread low pressure area is called the monsoon trough. The south easterly trade winds of northern hemisphere on crossing equator get deflected towards north east and becomes the southwesterlies. The vertical profile of monsoon air is 1-3 km in height from sea level.

The SW monsoon arrives at Kerela coast, Bengal delta and Meghalaya on 1st June, and in Orissa between 5-10th June. The arrival in Orissa is first on the coastal tract and the whole of the state comes under monsoon by about 1st of July. The date of onset is mostly maintained except in rare times they shift 2-3 weeks earlier or later(1918 & 1955 recorded earlies monsoon onset earlier by 20 days while 1972 record latest monsoon delayed by 17 days).

Retreating SW Monsoon (Oct.- Nov.) : The part of the SW monsoon that goes over Arabian sea to strike south eastern India is called the Arabian sea branch and that going to strike Deltaic Bengal & Meghalaya is called Bay of Bengal branch. The unspent moisture of the two branches of the south west monsoon which has not rained down still and hovered in the retreating winds give rain on the northern to north eastern sides of the hills when they retreat southwards. This phase, called as retreating SW monsoon, occurs during October-November after the end of SW monsoon period and before the beginning of the NE monsoon which comes from

the central Asian region during December-January. One glaring difference between the retreating SW and the NE monsoon seasons is that the latter is associated with the cold spell while the former is not.

High Rainfalls : The fluctuations in the intensity of south west monsoon is brought by the Somali Low Level Jet Stream flowing in the upper troposphere towards the Indian subcontinent from south across equator between 30°-40° E longitudes at an altitude of 850mb level. When it extends to the Indian peninsula across the Arabian Sea the monsoon conditions in Orissa and the rest of the Indian Subcontinent are strong and vigorous. This jet stream brings the tropical depressions from the Bay of Bengal. These depressions give more rainfall than the rain brought by monsoon and consequently the highest rainfall occurs along the track of these depressions.

Severe Storms : The withdrawl of SW monsoon in the Indian Subcontinent starts from early September where as in Orissa it starts from about 15th October. During this time tropical storms develop on the Bay of Bengal often leading to very severe storms having a very large destructive potential. The storms develops over Bay of Bengal when the temperature is more than 26°C. The storms of the Bay of Bengal are much more destructive than the storms developing over Arabian Sea, off the western coast of India. The storms strike Orissa, Andhra & Tamil Nadu coasts and move NW or W. The rainfall of the season come mostly from depressions of Bay of Bengal. During this season the temperature considerably falls and nights become cool.

SPATIAL PATTERNS OF RAINFALL

The global atmospheric circulations, the seasonal shift in wind system, the latitudinal placement and the proximity to Bay of Bengal indicates only four possible sources of rainfall in the state of Orissa-the SW monsoon, the retreating SW monsoon, the NE monsoon and the Depressions/storms of the Bay of Bengal. The SW monsoon gives rainfall during mid-June to mid-September, the retreating SW monsoon gives rain during mid-September to December. The depressions that bring storms and cyclones contribute abundant rainfall between April to December with peak contributions during July-August and during October-November. The NE monsoon, supposed to give rainfall during December-February, causes insignificant amount of rain, mostly confined to narrow coastal tracts of south Orissa and Phulbani-Phiringia region, as the air flow comes from central Asian land mass(The NE monsoon gives good rain only to parts of Indian subcontinent south of Orissa).

The eastern and northern Sambalpur, the western Sundergarh, the Sadar subdivision of Kendujhar, the Nowarangpur, Malkangiri, and Jaypur areas of Koraput and the Phulbani-Phiringia region of Phulbani receive a total of above 140cm rainfall from the onward SW monsoon, retreating SW monsoon and the rain bearing depressions from the Bay of Bengal, together called the summer rains. The rest of the areas of Orissa receives less than 120cm rainfall.

From the winter rain the north eastern Sambalpur, northern Kendujhar, Mayurbhanj, central Balasore comprising the Sundergarh-Baripada belt, the Phulbani-Phiringia region of Phulbani, and the coastal and Khurda areas of Puri district obtain more than 5cm rainfall.

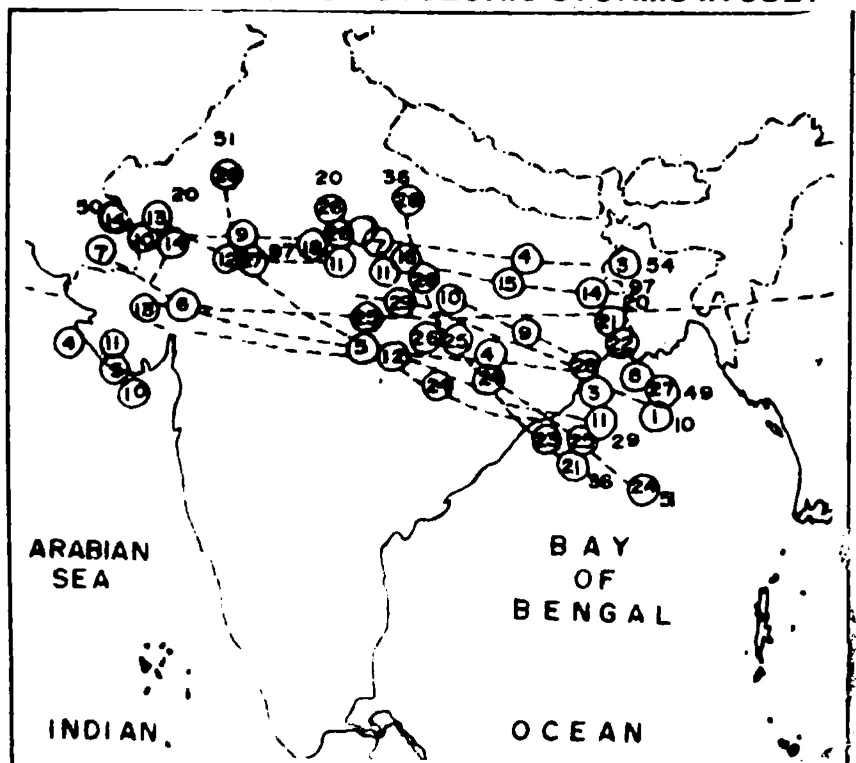
Considering the annual rainfall, the entire Mayurbhanj district, the northern & western Kendujhar, the northeastern portion of Dhenkanal, the district of Sundergarh, the eastern Sambalpur, the Nowrangpur, Jeypore Malkangiri areas of Koraput, the Phulbani-Phiringia region of Phulbani, the areas between Bhadrak, Sukinda, Kendrapara, and Cuttack receives more than 155cm of rainfall in the course of the year. While the north eastern tracts of Koraput, most of areas of Ganjam, the western part of Puri district, the tracts east of Chilika , the Bargarh subdivision of Sambalpur, the Titlagarh, Balangir and Patnagarh subdivisions of Balangir, and the Angul-Talcher belt obtains less than 135cm of annual rainfall. The rest of the areas of the state receives between 135-155cm rainfall per year.

The high annual rainfall of the Mayurbhanj district, the northern & westeran Kendujhar, the northeastern portion of Dhenkanal, the district of Sundergarh and the eastern Sambalpur comprising the Sundergarh-Baripada belt is due to copious rainfall brought by depressions as these areas are located in the track of cyclones. The areas depicting low annual rainfall areas due to the fact that neither elevated hill obstructions occur here nor rain carrying clouds pass over them.

The entire Mayurbhanj district, parts of Kendujhar district, the southern and western halfs of Koraput district on the western slopes of Eastern Ghats experience highest number of rainy days. Extremely low no. of rainy days are seen along the coastal belt and in the Nawapara-Padampur belt of western Orissa. The rest of the areas experience medium no. of rainy days per year.

The number of rainy days during the monsoons is very important in the causation of agricultural droughts and depicts another interesting pattern. During the summer monsoon season the

NORMAL TRACK OF CYCLONIC STORMS IN JULY



Source : Indian Meteorological Deptt.



The studies conducted by Dr Lenka brings out the variation of annual rainfall mean for every 5 year intervals as well as every 10 year intervals since the turn of the century.

Table - 3 : Quinquennial & Decenial variation of Rainfall in Orissa

Quinquennial Rainfall		Decennial Rainfall				
Period	Mean Annual Rainfall(cms)	Period	Mean Annual Rainfall(cms)	Period	Mean Annual Rainfall(cms)	Running Mean
1901-05	138.4	1946-50	134.9	1901-10	144.3	144.3
1905-10	147.0	1951-55	138.2	1911-20	148.3	144.2
1911-15	144.5	1956-60	142.6	1921-30	146.7	145.0
1916-20	153.0	1961-65	132.3	1931-40	154.6	147.3
1921-25	140.2	1966-70	135.7	1941-50	140.9	147.8
1926-30	150.7	1971-75	132.4	1951-60	141.9	143.9
1931-35	150.0	1976-80	114.5	1961-70	132.1	142.4
1936-40	158.9	1981-85	133.7	1971-80	124.2	140.0
1941-45	155.1	—	—	1981-85	132.9	139.4

The mean annual rainfall of 139.4cm over the first three quarters of the present century has the coefficient of variation of 4.7 to 29.3 percent though overall coefficient of variation is 13.27% and overall standard deviation is 18.6cm of rainfall.The rainfall showed a rising trend since the beginning of the century to the end of fifties and then declined from sixties onwards.The mean annual rainfall over five year periods declined after 1950-55 and touched the bottom of 114cm in 1976-80. Similarly the mean annual rainfall declined since the thirties. Besides the running mean of cumulative periods increased upto fifties & then declined.

The coefficient of variation is highest in Kalahandi and Sundergarh; followed by Keonjhar, Sambalpur & Bolangir; Dhenkanal, Phulbani, Puri, Ganjam & Cuttack, Mayurbhanj & Koraput and lastly by the least varying Baleswar. The total number of rainy days also demonstrate a decreasing trend.

TROPICAL DEPRESSIONS, CYCLONES & HURRICANES

The number of storms in the Bay of Bengal is much greater than over the Arabian Sea. Maximum number of storms in the Bay of Bengal occur in the months of October and November. In the Arabian sea the largest number of storms are observed in May, June, October and November. The early part of the monsoon season is favourable for the formation of tropical storms in both the Bay of Bengal and the Arabian Sea.

Table - 4 : Frequency of Cyclonic Storms in the Bay of Bengal and Arabian Sea - 1891-1960

Month	Bay of Bengal	Arabian Sea
January	4 (1)	2 (0)
February	1 (1)	0 (0)
March	4 (2)	0 (0)
April	18 (7)	5 (4)
May	28 (18)	13 (11)
June	34 (4)	13 (8)
July	38 (7)	3 (0)
August	25 (1)	1 (0)
September	27 (8)	4 (1)
October	53 (19)	17 (7)
November	56 (23)	21 (16)
December	26 (9)	3 (1)
Total	314 (100)	28 (48)

The figures within brackets indicate the number of Storms of "severe" intensity.

The month of May shows a rise in the number of Bay storms. Most of them have their origin between 10°N and 15°N during the month. But, as the monsoon sets in, the region where storms are generated appears to move northwards. Almost all storms in the Bay of Bengal have their genesis between 16°N and 21°N and west of 92°E in June. By July the Bay storms form north of 18°N and west of 90°E. It is also noteworthy that most July storms move along a westerly track. They are generally confined to the region between 20°N and 25°N and recurvature to the Himalayan foothills is comparatively rare.



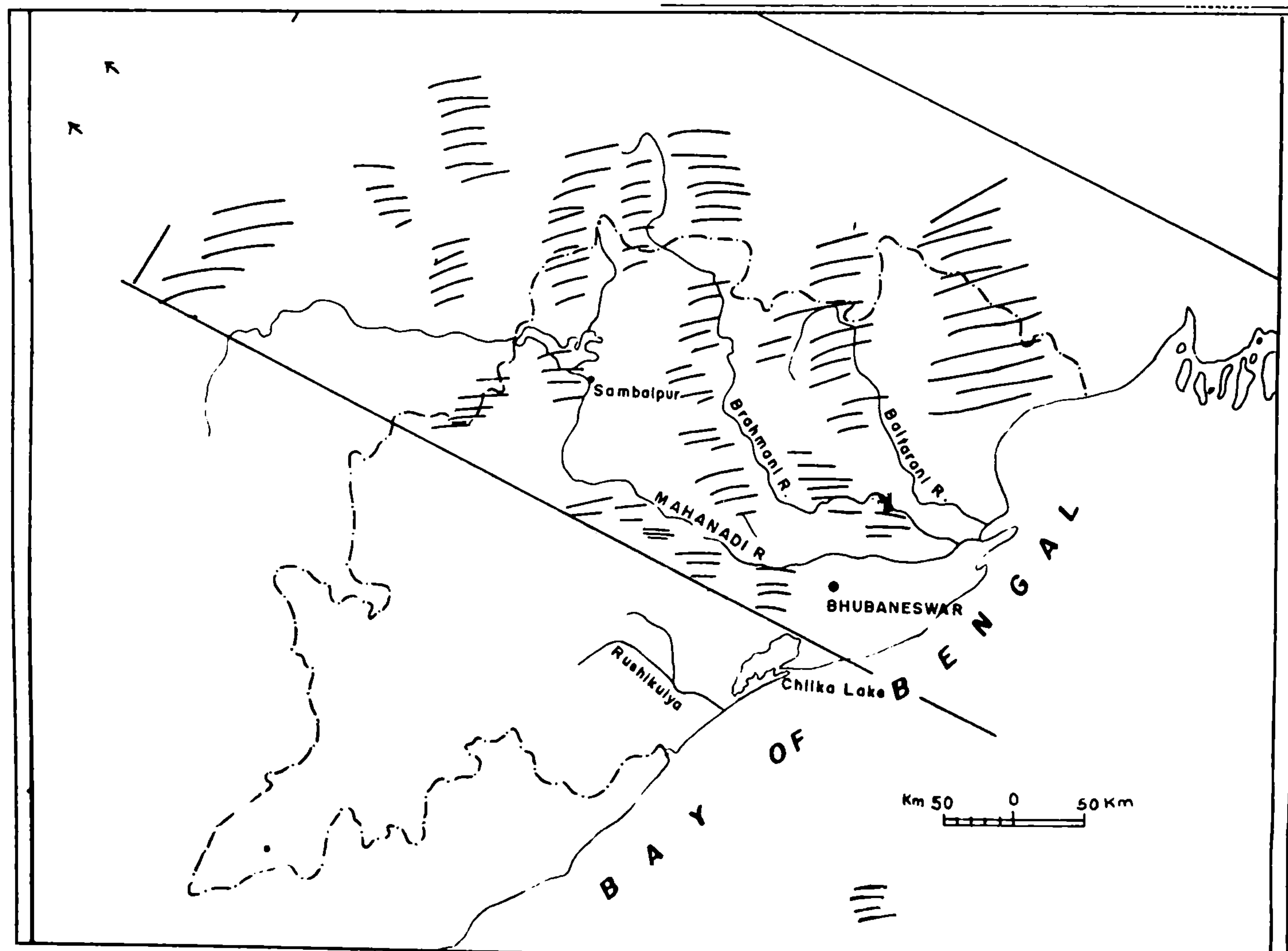
coastal tracts experiences less number of rainy days. During the winter monsoons the Mayurbhanj, Kendujhar, parts of Sundergarh district, the hilly regions of Dhenkanal and Cuttack betwen Brahmani and Mahanadi, the hilly tracts of Puri, Ganjam, and Phulbani between Mahanadi and Rushikalaya, the hilly tracts of Ganjam and Phulbani between Rushikalaya and Vanshadhara experience more number of rainy days the rest of the areas of the state experiencing much less number of rainy days. Dr B.N. Sinha has undertaken an elaborate study of spatial variation of the rainfall and rainy days in the state.

ERRATIC CHANGES IN RAINFALL

A glance at the districtwise annual rainfall since the beginning of the century till the present times indicate that before the end of 1950s the rainfall was less erratic with most years receiving normal or above normal rainfall. The rainfalls became much more erratic since the 1960s and most years recorded rainfall below normal. This is true for all the districts. Of the years before 1957, 67 to 90 per cent of the years recorded normal or above normal rainfall for various districts. While after 1957, only 32 to 68 percent of the years recorded normal or above normal rainfall for various districts. This demonstrates the extent and the intensity of changes and the erraticity of rainfall in the state. The district by district analysis reveals another interesting trend. The percentage of years with normal or above normal rainfall has gone down from 90 to 48 in case of Koraput, 88 to 43 in case of Sundergarh, 84 to 50 in case of Phulbani, 82 to 53 in case of Cuttack, 74 to 46 in case of Balasore, 77 to 50 in case of Puri, 75 to 43 in case of Mayurbhanj and 77 to 43 in case of Dhenkanal which is appalling. Only in case of Kendujhar 68 percent of the post-1957 years recorded normal or above normal rainfall which had 70 percent of pre-1957 years receivingg normal or above normal rainfall.

Table - 2 : PERCENTAGE OF YEARS WITH NORMAL, INCREASED AND DECREASED RAINFALL

District	1901 - 1957				1958 - 86			
	D	N	I	N+I	D	N	I	N+I
Phulbani	16	40	44	84	50	32	18	50
Sambalpur	26	28	46	74	50	32	18	50
Kalahandi	30	39	31	70	46	29	25	54
Koraput	10	60	30	90	52	26	22	48
Sundergarh	12	28	60	88	57	29	14	43
Bolangir	33	30	37	67	68	11	21	32
Ganjam	21	49	30	79	50	32	18	50
Cuttack	18	54	28	82	47	39	14	53
Balasore	26	44	30	74	54	29	18	46
Puri	23	42	35	77	50	36	14	50
Mayurbhanj	25	30	45	75	57	25	18	43
Kendujhar	30	35	35	70	32	43	25	68
Dhenkanal	23	49	28	77	57	29	14	43



RAIN SHADOW AND LOW OROGRAPHIC EFFECT

Bargarh-Titlagarh-Sinapalli-Nawapara-Bargarh region is the largest single area of the state facing dearth of rain due to three causes. As it is surrounded by hills and high lands on the west, southwest and south it comes under the rainshadow effect of SW monsoon. Secondly the retreating monsoon does not give much rain as there is neither any obstruction on its path nor is the region high enough to give altitudinal effect to cause rainfall. Thirdly the region does not occur close to the mean cyclone path. The only factor that kept rainfall stable was the forest cover that kept nights and days cooler and through evapotranspiration contributed moisture that might have kept humidity just above threshhold percentage just necessary for condensation. As the area has been deforested completely, the cooling backed condensation and evapo-transpiration moisture contribution is not adaequate which is probably the reason for frequent droughts and initiation of the desertification process over the area.

On the otherhand the Nabarangpur plateau though rainshadow zone of the Dandakaranya hills have enough altitude to enable cooling and condensation. Another example is the Nayagarh-Berhampur-Rambha-Gania region which get less rainfall due to the rainshadow effect of the SW monsoon, low altitudinal nature of the region and staying away from the mean cyclone path. Another example is the Champua-Anandpur belt along side the Baitarani River comprising the eastern Kendujhar and western Mayurbhanj region. The region gets rainfall due to incoming low pressures from Bay of Bengal and due to dense forest on east (Similipal) and west (Mankadanacha).

The Ranipur-Jharial rain shadow zone in west Orissa.



Pix : Ghani Zaman for CPSW.

RAIN SHADOW ZONES OF S.W. MONSOON



Source : Susanta Kumar Dash, ORSAC, Bhubaneswar.

DROUGHT & DESERTIFICATION

The orientation of hills, and relief distribution and the occurence of mean low pressure track catalysed by the forest cover are the root cause of drought & desertification. The northern Orissa get floods because of windward obstruction of the SW monsoon and the process of depressions obstructed by high lands north and north-west of Orissa border, NS oriented hills of northern Orissa and MP such as Similipal and Mankadanachha hills of Orissa, Ramgarh hillsof Bihar-Orissa-MP border, Maikala range of MP. The drought and desertification is caused by deforestation of areas under rainshadow effect, low orographic influence and distance away from the low pressure track.

RAIN SHADOW AREAS OF RETREATING MONSOON



Source : Susanta Kumar Dash, ORSAC, Bhubaneswar.

Cold Season & North East Monsoon : By December-January, 3km above in the troposphere, the westerly jet stream gets bifurcated by the Himalayas. One branch flows north of Himalayas and the other branch flows south of Himalayas along about 25°N in February at about 200-300 millibar level. This jet stream has a very important impact in shaping the winter weather in the Indian subcontinent. The western disturbances which enter the Indian subcontinent in the winter from the west & north west are brought by this westerly jet stream. As the winter gradually recedes, this jet stream weakens and the equatorial trough shifts north ward. This season depicts cold waves from north west direction. The disturbances that bring cold waves are felt in most of the areas of Orissa except the coastal tracts. The relief effect of Orissa accentuates this and often the cold waves in the highlands of Orissa are as severe as the cold spells in the Central Indian region. There are instances of snow fall in Daringbadi-Bamunigam areas of Phulbani, Sunabeda plateau areas(Nawapara Subdivision) and Karlapat-Thuamul Rampur areas(Bhawanipatna Subdivision) of Kalahandi district, Similipal areas of Mayurbhanj, as well as Pottangi-Kashipur-Muniguda tract of Koraput once in few years when the Indian subcontinent is extremely chilled by cold spell. After the passage of each disturbance widespread fog and haze also occur in this season pushing the temperature down by about 5-10°C.

North east monsoon has least contribution to Orissa because it mostly comes from land mass. Only a narrow strip of the coastal zone and plateaus of Phulbani & Phiringia get rainfall from this monsoon. The high rainfall received by northern Orissa during this time is from depressions that move west from Bay of Bengal.

Weather Mechanism of Hot Season(Grishma : March-May)

The ITCZ shifts north ward as the sun crosses the equator. Up in the air the westerly Subtropical Jet Stream withdraws from Indian subcontinent. This season is marked by high temperatures with maximum temperatures higher by many degrees above normal. Loos, dust storms and thunderstorms develops in this time. The sudden winds come mainly from North west, and are often violent and carry hails. These are called as "Kala Vaishakhi" in regional languages because they occur in the month of "Vaishakha" but are actually Norwesterlies. This season is also marked by easterly waves such as lows and cyclones in addition to increased thunder-showers in evening and nights. These thundershowers contribute bursts of rain in a few minutes and then stops. The dried land of Grishma, the empty tanks/ponds and the sun burnt people find temporary relief from this series of thunder showers. The last phase of the Grishma is the precursor of the summer monsoon and finally after middle of May a cyclone on the Bay of Bengal or a low pressure trough near the Kerela coast ends the hot weather season for monsoon arrival.

SPECIAL WEATHER PHENOMENA : A POINTER TO MICROCLIMATIC VARIATIONS

A view of special weather phenomena such as hail, thunder, fog and dust storm reveals local diversities, pointing to disparities in the microclimatic parameters of the state. Accordingly the review of monthly and yearly normals of 1931-60 period reveals an interesting story. The annual incidence of hail in the coastal tract is 0.2 days per year except 0.6 in Balasore and the hail incidence in the rest of the state varies between 0.1 to 0.2 days per year. Hail is confined to February - April period only. Thunders are experienced significantly during the April-October period, the rest of the year experiencing marginal incidence of it. The coastal tract experiences less thunder days per year in the south (38 & 30 days in Gopalpur & Puri respectively) than in the north (59 & 83 days in Chandbali & Balasore respectively). The rest of the Orissa experiences thunder days of 77 in Angul, 53 in Sambalpur and 36 in Titlagarh during a year. Regarding fog, June is the fog free month for the entire state and June-September period is the least or no fog period while all the other months experience some fog. The coastal tract is divided into three zones as regards the number of days of incidences of fog per year. 2 and 3 days in Gopalpur and Puri respectively are followed by 13 and 10 in Cuttack and

Chandbali respectively followed by only 3 days per year in Balasore. As regards the rest of the state the microclimatic variations result in wide variation of fog. Only 5 days per year in Koraput is followed by 19 in Titlagarh (highest in the state) followed by 8 and 10 in Sambalpur and Angul. Dust storms are felt mostly between February-June period followed by lack of it during the rest of the months, the months of November and December being free of dust storm altogether. Highest incidence of dust storm is recorded in Sambalpur while Gopalpur as also Chandbali experience lowest incidences per year. The coastal tract experiences 0.1 and 0.6 days per year in Gopalpur and Puri respectively, 5 in Cuttack, 0.1 in Chandbali and 1.8 in Balasore. In the rest of the state the number of days per year are 1.9 & 2 in Angul and Sambalpur respectively, 6 in Titlagarh and only 0.1 in Koraput. The incidence of squall decreases from south to north along the coastal tract. 3 in Gopalpur is followed by 2 in Chandbali followed by 0.7 in Balasore. The rest of the state experiences negligible amount of squall recorded as 0.2 in Sambalpur while 0.8 in Titlagarh. December is the squall free month for the entire state. The coastal tract receives squall during the rest of the months even though on fraction of days, however the rest of the state receives squall only during January-April period.

TEMPERATURE ZONES

On the basis of temperature data from 18 meteorological stations of Orissa, over a period of 10 years from 1977 to 1986, the state has been divided into six temperature zones. This takes into account the combined effect of insolation, relief features, proximity to the Bay of Bengal, humidity and condensation, winds, presence or absence of vegetation cover all of which influence the temperature and create variations of temperature on days and nights and from season to season.

TABLE - 5 : TEMPERATURE DETERMINANTS

ZONES	DETERMINING FACTOR	MEAN TEMPERATURE	
COASTAL PLAINS	PROXIMITY	5 - 6 km	26.9°C
COASTAL INTERIORS	"	6 km more	27.1°C
RIVER VALLEY & FLOOD PLAINS	"	—	26.8°C
ROLLING UPLANDS	ALTITUDE	153 - 305m above sea level	27.3°C
PLATEAUS		305 - 610 M above sea level	26.0°C
MOUNTAINOUS REGIONS	"	610m and above	25.4°C

In a broader categorisation of temperature zones, Orissa can be divided into two halves, the Eastern and the Western, considering the distance from the sea coast. In the first half, the temperature is determined by the proximity to the sea, while in the second half it is determined by the altitude. All this must of course take into account local influencing factors, like vegetation cover, inland water bodies etc. The coastal plains have a mean temperature of 26.9oC, recording a slight increase in the interior, going down in the river valley and flood plains and peaking in the rolling uplands, where the distance from the sea coast is large and elevations not very high. Again, the temperature reduces and records a big low in the mountainous regions. The mean diurnal range also varies in the temperature zones following the same characteristic rise and fall, as one travels away from the sea coast to the mountains.

The diurnal range in the mountainous region varies in accordance with the altitude of individual mountain ranges. For example, the mean minimum temperature of Phulbani is only 17oC while that of Koraput is as high as 23.5oC. The daily range in these two places thus varies as much as 13.5oC and 7.1o respectively. An inhabitant of Phulbani is hence exposed to a greater daily temperature variation than, say, an inhabitant of Puri.

The variations of the annual mean temperature between the hottest and coldest months are also determined by proximity to the sea and altitude. It records a minimum in the coastal plains, peaks in the rolling uplands and lowers as one goes towards the mountains. The only exception to this is the mountainous regions, where once again the mean annual range differs as the heights of individual mountain ranges differ. Thus Phulbani records a mean annual range of 13.0oC between the hottest month, while Koraput records a low 10.1oC. In the event of global warming, the temperature will definitely increase and it will follow the same pattern of variation. An analysis of temperatures at various centres reveals that the temperature has been rising gradually in the last half a century (1935-1985).

Table - 6

STATION	1936-40	1941-45	1946-50	1981-85
BALASORE	26.57	26.62	26.81	26.66
CHANDABALI	26.85	26.92	26.94	26.20
PURI	26.89	26.91	27.03	27.27
GOPALPUR	26.71	26.60	26.62	26.96
CUTTACK	26.69	28.14	26.51	26.69
ANGUL	26.69	26.90	26.87	27.43
SAMBALPUR	26.69	26.73	26.97	26.99

Source : B.N Sinha, Geography of Orissa.

MERCURY RISE

The mean daily maximum temperature of the state is gradually increasing so also the mean daily minimum temperature. The Titlagarh and Koraput belt covering the entire south and western Orissa has under gone large increase of daily maximum & daily minimum temperature. All the coastal stations such as Gopalpur, Puri, Chandabali & Balasore have registered higher mean daily maximum temperatures during 1930-60 period while the stations of interior areas have gone down. The sobering effect on the temperature has decreased

Table - 7 : Changing Trends of Orissan Temperature

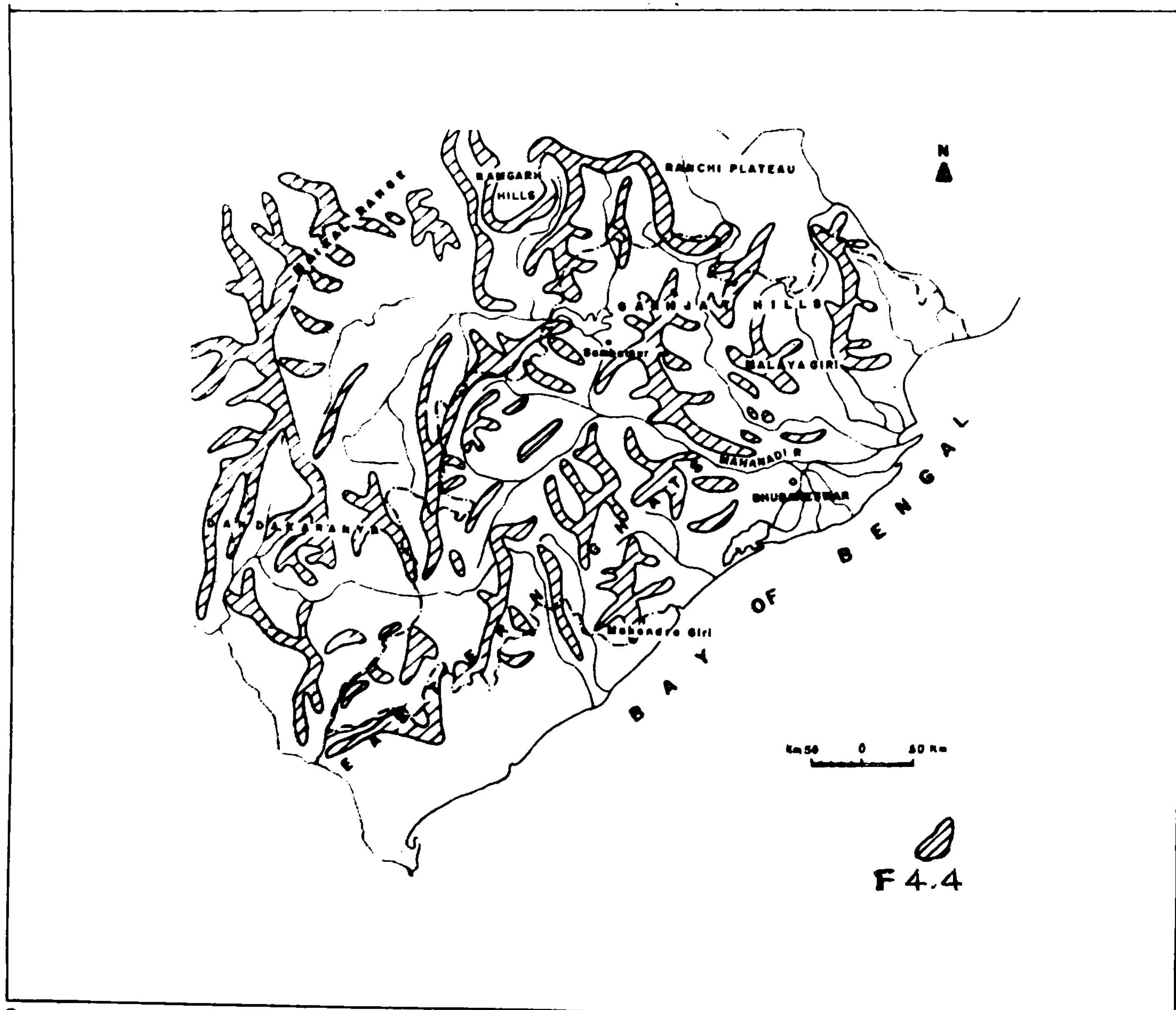
Station	Annual Mean 1931-60	Daily Max. 1977-86	Annual Mean 1931-60	Daily Min. 1977-86
Gopalpur	30.3	30.8	23.0	23.5
Puri	30.0	30.4	24.1	23.7
Chandbali	31.5	31.8	22.1	21.4
Cuttack	32.9	33.2	22.5	20.2
Balasore	31.5	31.8	22.0	21.7
Angul	32.5	31.9	21.5	21.5
Sambalpur	32.9	31.9	20.8	21.3
Titlagarh	33.0	36.3	21.3	21.4
Koraput	28.1	30.6	17.8	23.5

\RELIEF ORIENTATION - THE MAJOR FACTOR FOR ATMOSPHERIC CONTROL

The orientation of hills and the general relief in and around Orissa exercise an influence on Orissa's atmosphere. The incomprehensive vagaries of Orissa atmosphere is easily explained when the relief features of Orissa and the surrounding areas of West Bengal, Bihar, Madhya Pradesh and Andhra Pradesh are seen in synoptic view. Orissa is surrounded on north, north-west, west, south-west, and south by hills and high lands all of which are above 300 metres altitude. This horse shoe shape highland region encloses the entire stretch of low relief areas (below 300 metres altitude) drained mainly by Mahanadi, from Bhawanipatna to Sundergarh along north-south direction and from Raipur (M.P) to Dhenkanal along west-east direction. The orientation of hills and hill ranges within and outside the state is still important in view of its potential to control air flow. The SW-NE oriented Eastern Ghat ranges along Polavaram (A.P) - Koraput - Phulbani axis, the N-S oriented hills of western Koraput and Kalahandi which form a small part of extensively E-W spread Dandakaranya Hill system, the NE-SW oriented Maikal range in M.P located west of Bilaspur, the E-W oriented Ramgarh Hill system of M.P and Bihar located north of Sundergarh, the N-S oriented hills between Baripada and Keonjhar, the NNW-SSE hills west of Keonjhar and east of Brahmani offer the setting that has potential of guiding flow or offering a barrier to the monsoon forays into our state.

The mountainous country of Orissa, covering three-fourth of the area, having elevations ranging from 610m to 1068m above mean sea level, keep the surface air temperature of these areas 4°C to 6°C lower than sea level altitude here. The subdued plateaus (305-610m elevation over msl) in Keonjhar & Koraput also have air temperatures lower by 2°C to 4°C than would have been the value for sea level at this place. The effect of relief is less felt in rest of the areas in the state. The orientation of hill ranges and the highlands within and outside the state when juxtaposed with monsoon flow paths create the vagaries of rainfall distributions within the state. It is this synoptic view of the Orissa and adjoining region that easily explains the differences in annual rainfall normals and gives true perspective to trends of drought, desertification and floods that bedevil Orissa.

OBSTACLES TO MONSOON & DEPRESSION FLOW



Source Susanta Kumar Dash, ORSAC, Bhubaneswar.

VEGETATION LOSS CAUSING MICRO-CLIMATIC IMBALANCE

Orissa 's forest cover has comedown from about 68,000 sq.kms to only 47,000 sq.kms. The type, location & extent of vegetation cover in view of their capacity to evapotranspiration contribution play an important role in Micro-climatic balance and moisture conditions. The semi-evergreen Similipal forest never entirely going leafless during any time of the year plays a major role in evapotransmission contribution. In contrast the forests of the rest of the areas which remain leafless for months in view of their deciduous character contribute less moisture to the atmosphere. The coastal forests are too small to have any meaningful state wide impact. Areas such as Bolangir, Nawapara, Koraput, parts of Sundergarh and Keonjhar have lost maximum forest cover due to timber export and smuggling, developmental activities such as Dams, Mines and Industries are now suffering from more drought and desertification.

Increasing Human Activities : Greater Contribution to Climate Change :

The growth of settlement, transport and industry contribute to microscale (1-100m) and mesoscale (1-100km) fluctuations within the atmosphere. By this time about ten industrial zones and as many urban settlements have come up in our state. Vehicular traffic has increased by leaps and bounds. Thermal power and other big industries are increasing in number. The high density of population in the coastal areas exposes them to the risks of high causality during atmosphere induced phenomena like cyclone, flood, storms surges, etc. Finally the air within houses have become more stale too. Use of more cowdung and wood to fire, inefficient Chullas to cater to increased number of poor population per household, exposes more people, especially women, to affected domestic air.

MICRO-CLIMATE, MESOCLIMATES & SYNOPTIC CLIMATES : A CASE STUDY

According to an analysis by Prof. M.C.Dash and Prof A.B. Mishra of Sambalpur University the climatic data around Hirakud Reservoir in West Orissa indicates a decrease in rainfall and number of rainy days, and morning relative humidity. The mean minimum and maximum temperature, evening relative humidity and atmospheric pressure show increasing trends. Relationships between forest loss and climatic parameters are significant for morning relative humidity, rainy days, maximum temperature and atmospheric pressure.

Sixteen miles from end to end, Hirakud is the world's longest mainstream dam, over 'the Mahandi' River. The reservoir, with a water spread of 184598 acres (288 sq miles) has a storage capacity of 6.6 million acre feet of water and supports two power houses at Burla and Chiplima generating 85,500 KW of power and irrigating 6.72 lakh acres of land.

From among the possible trends of deforestation between 1929-1975 the semi-logarithmic trend fits to a hypothesis that after the 1950 implementation of developmental plans and rapid urbanisation, forest loss has been rapid. Average rates of deforestation between 1950-60, 1960-70 and 1970-75, compared through the slope factors, indicate that the rate was higher during 1970-75 than the other two periods. During these five years forest was lost more rapidly around Sambalpur than Jharsuguda but in the earlier decades it was more rapid around Jharsuguda than Sambalpur, probably due to earlier industrialisation and urbanisation around Jharsuguda. The average rate appears to be three times as rapid during 1960-70 around Sambalpur in comparison to 1950-60 which is more than ten times during 1970-75 (slope factors being 0.3, 0.94 and 3.52, respectively). Around Jharsuguda the average rate during 1950-60 triples during 1960-70 and quadruples during 1970-75 (slope factors being 0.36, 1.08 and 2.24, respectively) showing deforestation to be an accelerating process.

Table - 8 : Forest cover of different years around Sambalpur & Jharsuguda

Around	Area in sq. miles 1929	1975	Loss
Sambalpur	409.07	234.70	174.46
Jharsuguda	381.28	204.32	176.97
Percentage of total forest area lost (1929-1975)	43	46	

A polynomial analysis of the climatic data reveals a decreasing trend for total annual rainfall and rainy days around Sambalpur and Jharsuguda. Mean maximum temperature shows an increase between 1940-60 and then remains constant in the polynomial trend analysis, whereas the mean minimum temperature shows a decrease between 1940-60 and then takes up an upward trend.

Mean morning relative humidity shows a decreasing trend between 1940-70 but the evening relative humidity shows an increase between 1940-60 and then takes a constant trend. Analysis of rainfall by the twenty year moving average curve (Winstanley, 1973) also indicates a decreasing trend. The mean rainfall of the decade 1967-76 being 141.15 cm compared to the mean of two periods. 1871-1950 and 1950-1976 with means of 165.1 cm and 155.97 cm, respectively, indicates clearcut decrease of 16.97% and 9.55%, respectively. The decennial mean of 1967-76 is the lowest compared to the preceding decennial periods starting with 1940. The number of below average years for rainfall during 1967-76 is the highest in comparison to the earlier decennial periods. The decennial period 1967-76 also has the highest number of years showing a deficit of more than 20% of average rainfall in comparison to the other decennial periods.

Table - 9 : Comparison of climatic parameters at Sambalpur during two periods, 1871-1950 and 1940-1980

Mean (cm)	S.D. (cm)	Coefficient variation(%)	Highest Annual rainfall as % of mean	Lowest Annual rainfall as % of mean		
Rainfall(cm)						
1871-1950	165.1	9.47	14.6	140	57	
1940-1976	155.97	39.98	25.63	142.63	65.15	
Temperature Coefficient °C)	Mean max. (°C)	S.D.	Coefficient of variation	Mean min (°C)	S.D.	of variation
1874-1950	32,87	1.00	1.1	21.06	0.91	1.3
1940-1979	32.74	1.08	3.29	20.83	2.98	0.143
Relative Humidity*		8.30 hours		17.30 hrs		
1942-1976	68.56	6.57	9.59	53.29	4.26	8.00
Review Days*	69.20		13.01		18.81	
Atmospheric Mean pressure						
1892-1951			999.372		0.014	
1932-1972			1002.00		8.65	

* not available for the earlier years

An analysis for correlation between forest loss and climatic factors indicates that morning relative humidity changes are significantly correlated to forest loss but evening relative humidity is insignificantly correlated. Rainfall changes are significantly correlated and rainy days distribution is correlated with low coeffi-

MICRO CLIMATES OF ORISSA

ORISSA

LOCAL CLIMATIC ZONES

CLIMATIC ZONE

STATE BOUNDARY

RIVER

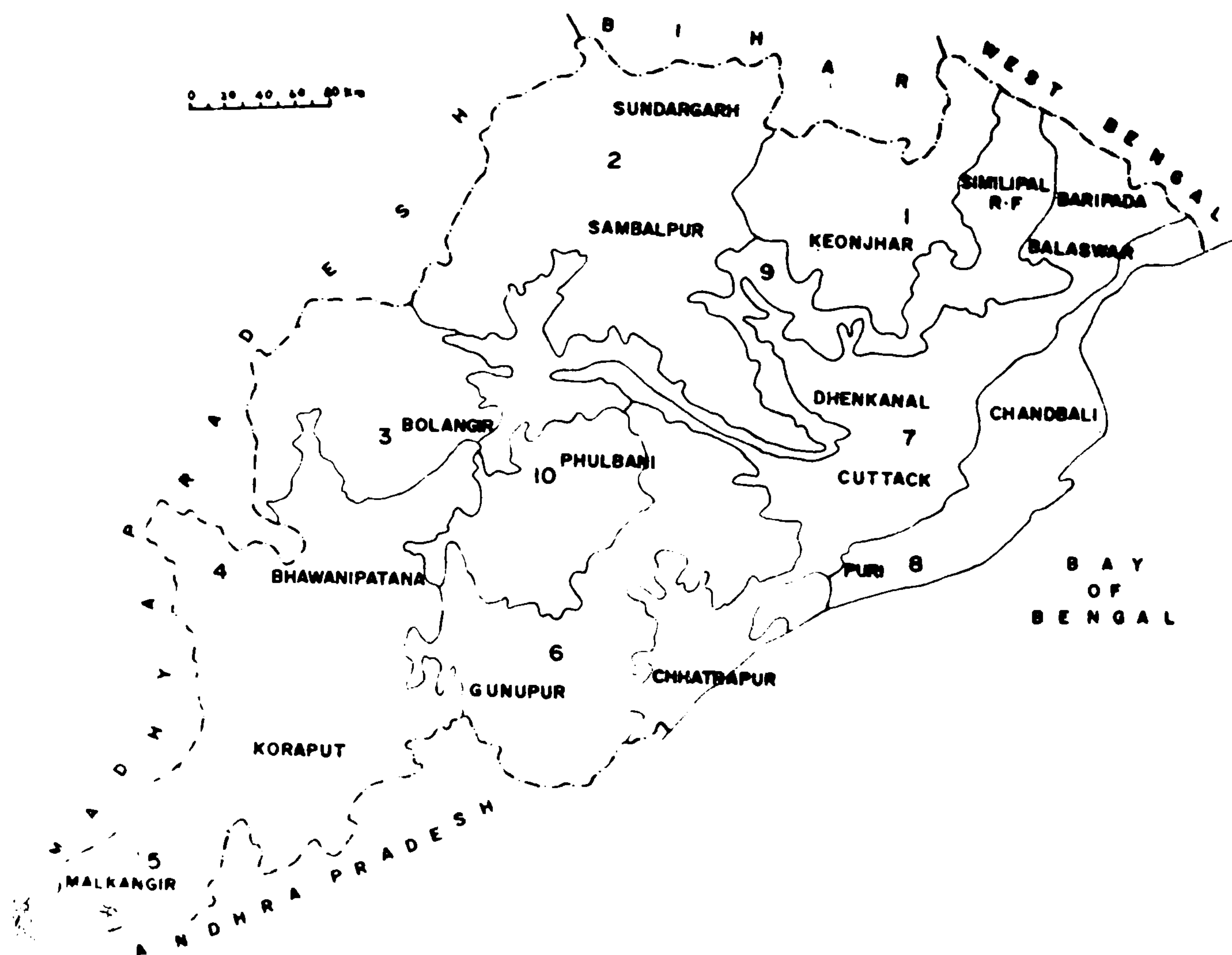
RESERVOIR / LAKE



Source : Susanta Kumar Dash, ORSAC, Bhubaneswar.

cient which is not significant. Minimum temperature distribution is negatively correlated being not significant. Maximum temperature is also negatively correlated. Changes in the atmosphere is related to forest loss. The loss in storage capacity of the Hirakud reservoir due to silt load from the deforested catchment area is also significantly correlated with forest loss. The increase in the relative humidity in evening at Sambalpur may thus be explained as an effect of the Hirakud reservoir but the morning decrease indicates that vegetation loss induced evapotranspiring of the area of dense multistoried forest is much higher than the evaporating surface of an artificial lake created at cost of the forests.

AGRO-CLIMATIC ZONES OF ORISSA STATE



Source : Dr. K.L.Pujari.

GLOBAL WARMING

The copious release of vituperative effluents, anthropogenic, industrial and agricultural is gradually destroying the delicate balance of the composition of gases in the atmosphere whose complex natural processes sustain life on earth. The fallout of this, is an ensemble of dangerous phenomena called ozone depletion and greenhouse effect, which in turn set off a chain of reactions that account for global warming and climatic changes.

MAJOR POLLUTANTS AND THEIR SOURCES

CARBON DIOXIDE : Fossil fuel combustion, deforestation and other form of changing land use, biomass burning, erosion.

CARBON MONOXIDE :Vehicle exhausts, industrial combustion, combustion of fossil fuels, biomass burning.

CHLORO FLORO CARBONS:Various industrial process and applications viz. refrigeration, foam insulation, computer chips etc.

METHANE & OTHER HYDROCARBONS:Biological decay in water logged areas, human and animal waste, enteric fermentation in cattle and termites, biomass burning oil and gas exploration, fossil fuel combustion.

NITROGEN OXIDE :Vehicle and aircraft emissions, industrial processes, high temperature fossil fuel combustion.

NITROUS OXIDE :Fertilizers,fossil fuel combustion, biomass burning, changing land use.

SULPHUR OXIDES : Fossil fuel combustion, industrial process.

SURFACE OZONE :Reactions involving other pollutants (carbon monoxide, methane and nitrogen oxides and sunshine.

OZONE DEPLETION :The life giving rays of the sun, can also have ill effects. Harmful ultra violet rays (UV-B) could unleash an epidemic of skin cancer, cataract and numerous other dangers to man, if the earth were not shielded by an ozone layer in the stratosphere. But sadly this layer is being gradually destroyed by air pollution.

This process is more evident at the poles. Over the Antarctica, spring ozone levels since the 1960s were observed to have declined by 40% and in 1991, this has decreased to as much as, 60%.. The possibilities of a similar, yet smaller ozone hole is predicted over the Northern polar region.

Depletion of 30% to 40% of the ozone layer is expected to affect the populous regions of such widespread countries as Canada, United States, Scandinavia, Russia, Germany and even parts of France and Britain.

Moreover, recent research has revealed that apart from CFC's, tiny particles called stratospheric aerosols and even stratospheric clouds speed up the process of ozone depletion by acting as catalysts and being the medium on which the complex chemical processes of ozone depletion takes place. This has brought about an alarming rise in the rate of depletion. Further, Robert Watson, chief adviser to the Montreal Protocol created great apprehension in the international community, when he declared that record low ozone layers were observed over Antarctica and that, for the first time ever, areas over Southern Chile and Argentina were exposed to the ozone hole (DTE Vol I, No.14, Dec 15,1992). Clearly, the earth is undergoing irreversible changes.

THE GREENHOUSE EFFECT

It is through the greenhouse effect that the earth maintains a global temperature of 13oC, without which life on earth could never exist. The absence of trace gases and the consequent lack of a greenhouse effect, would keep the temperature at -20oC, making the earth totally uninhabitable. Yet this is gradually becoming a reality. Man's interference in nature, in the form of release of pollutants into the atmosphere, increases the concentration of the greenhouse gases, like carbon dioxide, methane, ozone, nitrous oxide, chloro fluoro carbons etc., giving it more power to retain warmth and hence increasing the surface air temperature.

The UN sponsored Inter-Governmental Panel on Climate Change (IPCC) reports, that in the past hundred years the global surface air temperature has risen by 0.3oC to 0.8oC and is continuing to rise.

Gases	% of Contribution	Gases	% of Contribution
Co_2	50%	CFC's	20%
CH_4	16%	Ozone	8%
N_2	6%		

The IPCC estimates, that a mere 60% reduction in emission of gases, such as carbon dioxide would be required, to keep atmospheric concentrations at the present levels. But this is well nigh impossible. It is therefore predicted, that if anthropogenic emissions of Co2, (barring all other gases) continue at the present rate, then by 2070, Co2 concentration in the atmosphere could increase to twice as much as the pre-industrial level, causing a temperature rise of 1.5oC-4.5oC. The same temperature rise could occur by as early as 2030 AD if anthropogenic emissions of all gases including Co2 continue. As the oceans capacity to abort heat is greatly reduced in a warmer world, the temperature could shoot up even more quickly. Without ambiguity, we are heading towards a warmer 21st century.



Pix : Ghani Zaman for CPSW.

The impact of air pollution is reaching alarming stage. In recent years, the temperature of NALCO Nagar has gone up steadily.

THE IMPACT : CLIMATE CHANGE

Ozone depletion and the greenhouse effect together, have a cascading effect on the environment. The natural conditions of elements of the environment, like temperature, rainfall, oceans, bio-diversity, soil etc., are disrupted, creating a hostile earth.

The task of studying the effects of global warming and its impact on Orissa, is therefore a difficult proposition. But, the impact of global warning and the greenhouse effect are no less traumatic in Orissa, than the international scenario. Disruptions in temperature, rainfall, sea levels etc., will not only have a severe impact on the environment and ecosystem, but will also rupture the socio-economic life of the whole state.

Temperature Rise : This will undergo a rising trend, with global temperatures averaging between 1°C-5°C more than the present, by mid 21st Century. But the distribution of temperature will vary from place to place. A rise is expected by 2-4°C in tropical areas and by more than 4°C in the temperate regions. The Southern hemisphere will experience the greatest warmth. The areas between 60°S-70°S will be warmer by 6°E-12°C, or even more. This will cause the melting of Antarctic ice in a big way. On the whole, warming will be more pronounced in winter, than in summer.

Rainy Days Ahead : Global warming will cause greater evaporation and thereby result in more rainfall. A increase of 10% in mean global annual rainfall is expected by 2040 AD. As with temperature, the distribution of rainfall would vary. In general, rainfall will be more in the equatorial areas, while it will remain almost the same in arid and semi arid regions. In the lower mid latitudes, that is in the semi-arid Mediterranean regions, the summer rainfall is expected to increase slightly, while winter rainfall will record a rise of 5-10% The durations of wet and dry torrential rains will become common instead of uniform distribution. Considering the years of drought, excess rainfall and their frequency, Dr. Pujari divided the entire period of rainfall study into four periods that is 1901-57, 1985-71, 1972-81 & 1982-86 in case of Orissa. He observed that in the first 57 years of study, there was increased rainfall with only 9% of the period having drought conditions. The second section (1985-71) the trend was towards increasing conditions of drought amounting to 30% of those 14 years and in the third section of study (1972-81) almost 50% of the period was under drought conditions. The last period also recorded the same trend, but the later part of this period is of conspicuous nature.

Both Dr.Lenka and Dr. Pujari arrive at the conclusion, that from the trend of increasing rainfall at the beginning of the century to the mid fifties, there is a gradual but clear decrease, that is pronounced in the 70s and 80s. This trend of decreasing rainfall is more often attributed to deforestation. But conspicuous and abnormal rainfall towards late 1980s' and early 1990s may have a direct link to global warming.

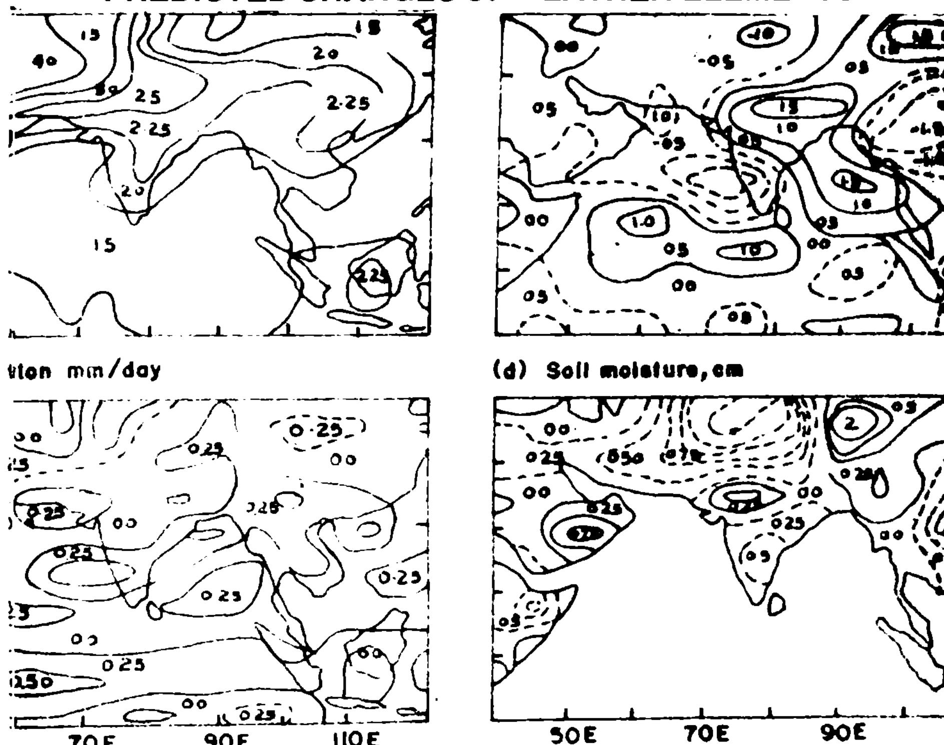
EFFECT OF GLOBAL WARMING ON INDIAN MONSOON

The impact of increasing greenhouse gas concentrations on the climate of Indian subcontinent and its variability is studied using the output from a time dependent greenhouse warming simulation as well as a reference control experiment performed with the Hamburg global coupled atmosphere-ocean circulation model at Germany.

Previous GCM-related studies of climate change in the monsoon region are based on numerical experiments conducted with the atmospheric models or with atmospheric models coupled to a simple mixed layer ocean. These simulations describe the equilibrium response of the models to instantaneous doubling of CO_2. More recent GCMs treat the coupled atmosphere ocean system in an interactive mode and are able to provide projections of the possible perturbations in key climatic elements in the time scales of up to 100 years. The control reference atmosphere has been simulated with the coupled climate model over a 100 year period from 1985 to 2084 with constant 1985 atmospheric CO_2 concentration. The model simulates the general structure of the mean atmospheric circulation reasonably well. In the ocean, the control run reproduces the observed salinity and temperature fields and is consistent with the conveyer belt picture of the global ocean circulation.

The global average near surface temperature increase of 2.6K lies close to the IPCC's best estimate. However, the global average temperature change in years 10-50 years of experiment is consistently lower than the IPCC estimates possibly due to the strong oceanic heat uptake resulting from a more realistic description of the deep ocean in the model.

IMPACT OF GLOBAL WARMING ON INDIAN MONSOON : PREDICTED CHANGES OF WEATHER ELEMENTS.



Source : M.Lal, U.Cubasch & B.D.Santer.

The model captures the characteristic features of the vertical distribution of temperature, specific humidity and winds as observed over the region. In the Hamburg climate model, three grid points along 19.67°N over the Indian subcontinent, one each over the west and east coasts of India and one over the central peninsular India, have been selected. The temperature increases by only 0.4K during the first 40 years but then the curve steepens to a growth rate of ca.0.3K per decade to reach 2.2K in 100 years. The greenhouse gas-induced warming for the monsoon region is thus only marginally lower than the global mean temperature rise (2.6K) simulated by the model.

The model simulates an increase in total (average for the study area) seasonal precipitation of 8 mm/month. The increase in evaporation after 100 years is about 0.6 mm/month for scenario A. The soil moisture is reduced by 0.2 mm after 100 years. Apparently, the relative increase in evaporation is more pronounced than the increase in precipitation in warmer atmosphere, leading to a decline in soil moisture.

The mean onset date shifts only by about 10 days, while most of the Indian subcontinent warms (statistically significant at 95% level) by over 2K over the next 100 years. The warming is most pronounced over the north-western margins of India. While less precipitation could occur over the southern peninsular India (statistically significant at 90% level), an enhanced precipitation largely confined over the central plains of India is simulated by the model. The evaporation rate over most of the subcontinent also increases (significant at 90% level only over south peninsular India) as a result of surface temperature rise. A depletion in soil moisture over the south peninsula and along the semi-arid regions of NW-India (Statistically significant at 90% level for both the locations) is simulated.

The results obtained from the greenhouse warming experiment suggest that the surface temperature could significantly change by _2K over the monsoon region in the next 100 years. For other relevant climatic variables, significant climatic changes could only be isolated over some areas. There is no evidence for a significant change in the mean monsoon rainfall or in its inter-annual variability. It may be stressed here that the present study is only one realization. Additional model simulations with different initial conditions and further experiments with a finer resolution model having more realistic convective parametrization in the tropics are desired to focus on these details.

LOSS OF BIO-DIVERSITY & LIFE-FORMS

In the coming decade, the rising Co2 level and climatic changes, will severely affect bio-diversity leading to several far reaching changes. Even a small temperature rise could cause insects to migrate to higher altitudes, thus disturbing the processes of pollination and dispersion.

A 3°C rise can effect the migration of plant communities at least 300 kms horizontally, towards the pole, or 500 m vertically along hill slopes. The first has been made impossible by man-made obstacles, while the second could disrupt the equilibrium between plant and animal communities. The fallout on coastal, brackish and marine ecosystems may be drastic, because of saline inundations.

The increase in Co2 levels and rainfall will lead to forest growth, yet rapid evaportranspiration, and infertility of soil will impede it. Intensive growth of weeds and large requirements of pesticides and fertilizers will prove to be a menace. The flammable variety of trees, possessing C3 photosynthesis cycle will grow in large numbers in a Co2 rich atmosphere, thus increasing the possibility of forest fires.

Increased UV-3 radiation will render lifeless most of the plants, fish, larvae, shrimps and crabs, which live near the ocean surface. On the whole, there will be an alteration in the growth rate of plants and animals, unpredictable changes in flowering and fruit bearing, pollination, dispersion, breakdown of the symbiotic relationship between plant and animal life, migration from hostile environments and establishment of new habitats, or total extinction.

Change in Soil-Moisture Conditions : Despite increased rainfall conditions, evaporation and evapotranspiration will effect a global change of soil moisture conditions. According to the glass model in the south and North East India, Eastern China, Northern and Eastern USSR (old), Northern America, Central America, Southern Australia and parts of South Antarctica, soil moisture will decrease, while in the parts of Asia, Africa, Europe and North America, it will increase. The decrease will be more prominent in warmer months, than in winter. Moreover, Co2 induced forest growth will result in the impoverishment of the soil. Simultaneously, soil which served as a Co2 reservoir will no longer absorb Co2, instead it will rapidly lose soil carbon, escalating the greenhouse effect.

Food Production : The rise of Co2 levels in the atmosphere, will be generally beneficial to plants. C3 photosynthesized crops like rice, potato, barley, wheat etc. will increase in yield, while Ch4 photosynthesized crops like maize, sorghum, millets, and sugarcane will remain more or less unaffected. Simultaneously, weed and pest growth will cause a menace, that will require more fertilizers and pesticides to fight it. Crops will also be susceptible to UV-B radiation, resulting in a reduction of the yield of many UV-B sensitive crops.

In spite of factors such as soil moisture, temperature, irrigation facilities, rainfall etc., which could influence crop growth, an overall increase of yields globally, is expected. This will have its impact on global food supply and trade, as the geographical distribution of the yield will be disrupted. Consequently, changes in natural economics and reorientations to International politics, will be forthcoming.

Health Hazards : Global warming and climatic change will have a direct impact on man. Increased UV-B radiation will unleash an epidemic of skin cancer and cataracts. At the same time, exposure to high UV-B radiations will gradually weaken the immune systems of man, thus making him more vulnerable to contraction of numerous diseases. The general rise in temperature will result in increased mortality, due to heat stress, cardiovascular and cerebrovascular diseases, and respiratory disease in a dustier world. More rainfall will make for new breeding grounds for mosquitoes, which consequently could increase cases of Malaria.

The magnitude and potential of these changes is alarming. A hostile environment is being gradually created and man is guilty of causing it.

GLOBAL WARMING & SEA LEVEL RISE

Another tangible hazard of the greenhouse warming, is the rise of sea levels. As warming increases, glaciers will melt and sea water will expand, making the rise more rapid. At present, the rate of rise is 1.2 mm/year, but due to global warming, the rise is predicted to reach 3.3 mm/year by 2025 AD, 6.6mm/year by 2050 Ad and 11.4 mm/year by 2075 AD, (according to the US Environment Protection Agency). Hoffna, Gornitz et.al, also predict an increasing trend of 3.5 cm by 2000 AD, 10-12 cm by 2025 AD, 20-55 cm by 2050 Ad and 36-192 cm by 2075 AD. Even a modest rise could flood thickly populated areas all over the world and could even submerge islands, like the Maldives, Seychelles and parts of Egypt, Indonesia, and Bangladesh.

Orissa, which has a 480 km long coastline and an abundance of rivers that flow into the sea, could be subject to a merciless onslaught by the monstrous seas. A modest sea level rise, would not only create havoc on the environment and ecosystem, it would also disrupt and render chaotic the very socio-economic system of the thickly populated coastal habitations.

Orissa's Coastal Tracts : The coastal tracts of Orissa are narrowest at Balasore in the north and widest in the south. Its low lying deltaic plains have an average height of 4-5 m above mean sea level, with some areas as low as 3-2 m above sea level. The deltaic tract, moreover, is cris-crossed by numerous rivers, nalas and tidal channels. Most of these rivers have typical estuarine characteristics. The coastal tract is also subject to all kinds of fluvial, aeolian, tidal and other marine activities and support a variety of land forms, such as sandy beaches, muddy shores, sand dunes, beach ridges, off shore lands, bars, spits, marshes and swamps.

Old Land Into New Watermasses : In the global warming scenario, the impact on this coastal tract is expected to be traumatic. A 0.5 - 3.5 m rise in sea level, as is predicted for the coming century, will drastically hit the coastal tracts. Most of the areas to the east, from Gop (in Puri district) to Jaleswar (in Balasore district), are only 2-4 m above mean sea level. In the event of sea level rise, these densely populated settlements and richly fertile areas are liable to be submerged. The areas between Rajkanika to Khakibat, the areas north of Mahakalpada and those between Gop and Kakatpur, which have a height of 2m or less above sea level, will be particularly affected.

Even if embankments along rivers, nalas and tidal channels and sand bars along the coast protect the settled low lying lands, by preventing the entry of saline water, rain water as well as sea water brought by high tides will stagnate over the low lying areas for months, as the water can't flow back into the sea due to the rise in the sea level. As a result, people will have to be evacuated from the area. The gradual sea level rise will cause further deterioration of the areas. Continuous stagnation of water will turn them into marshy land, finally submerging them altogether.

Saline Inundation Through River Channels : All the major rivers of Orissa, namely, Devi, Mahanadi, Brahmani and Baitarani form estuaries at their mouths and the tidal limit of each of these rivers is 45 km, 35 km, 90 km and 50 km respectively. The other tributaries have a tidal limit of 20-25 km. When the sea level rises, the tides will increase in height and all areas along tidal rivers and channels as well as along the coast will be inundated by salt water, thus destroying thousands of hectares of crop land and thereby affecting the socio-economic life of these regions.

Water Logging & Flooding : Heavy rains coupled with saline water flooding is predicted with extremely damaging consequences. As storm and cyclone potential will grow in the event of global warming, the height of the storm surges will increase to 6-7 m from the present 3-5 m and cyclones will bring heavier rainfall. The greater frequency as well as the severity of rainfall will result in floods of coastal plains. Already ravaged by

Pix : Project Swarajya



The rich coastal eco-systems and areas are threatened by sea level rise.

saline water flooding, the coastal plains will find no relief, as rainwater will only lengthen the duration and extent of flooding. The reversal of the flow of water from sea to coast due to a higher sea level will cause water to stagnate, destroying crops, submerging settlements, causing health hazards and even contamination of underground water. Such a scenario is not too far away in the future.

Nature Against Nature : Global warning is a phenomenon that is equally frightening, in its potential of wiping out life, as we know it. For, with the forces unleashed by man through global warning, we destroy the very delicate balance of nature, wiping out unique brackish waters, mangrove forests and rare bio-diverse reserves.

It is a common phenomena. Many species survive on others, even on their own kind. That is the way of nature. But not global warming induced sea level rise. In this case nature is pitted against nature due to reasons best known to man and the loss is his. Unique brackish waters, mangrove forests and rare bio-diverse species will be the victim of the man unleased seas.

I. Erosion of Natural Barriers : With the rise of the sea level, rapid erosion of the sandy coastal areas as well as natural barriers, such as spits and bars, is expected. This will not only reorient the beaches, which will be relegated further inland, it will also increase the potential of saline inundation, as spits and bars are gradually removed. The impact of such phenomenon on Chilika's lagoon characteristics & its surrounding coast will be disastrous.

In the event of sea level rise Chilika which is separated from marine waters by spits and bars, will witness a rapid erosion of its protective cover from the seaward side. Consequently the two mouths of Chilika (one at Arakhakuda and the other 15 km south) will gradually widen and render the brackish Chilika more salty. Simultaneously, the densely populated island villages in the Mirzapur - Bajrakot segment e.g. the Chilika coast, namely, Nuapara, Titipo, Krishnaprasad Garh and Brajhai, which are only 2m above sea level, will swiftly be submerged.

II. Destruction of Mangrove Forests : Erosion of natural barriers and tidal flooding damages another vital natural resource, mangrove forests, the tidal swamp forests habitats of Orissa, which are on the estuaries of the Subarnarekha, Budhabalanga, Baitarani, Brahmani and Daya.

Mangrove which requires a moderately flooded brackish water area for growth, will succumb to saline inundation as the sea level rises. This will not only be unfavourable to the growth of the forest, but in time will be flooded by salt water from higher tides. This will also destroy the sand coast habitat supporting littoral forests, like casiruna etc. Besides, as storms and cyclones increase, the mangrove and littoral forest will come to an end.

III. Impoverishment of Bio-diverse Species : The coastal tracts of Orissa are home to many rare species of animal and plant life. But the sea level rise will drastically change living conditions of the existing habitat, thereby seriously affecting the ecological links of wildlife, forests and birds.

The Bhitarkanika mangroves, which form a wildlife sanctuary for Gharials and the rare Ridley sea turtles, for whom it is the largest sea rookery in the world, may be completely submerged under salt water and rain water flooding. The same danger threatens the Balukhand wildlife sanctuary near Konark. Chilika which is home to many birds and which supports a variety of typical fishes and aquatic plants, due to its brackish nature, is in danger of extinction, if the Chilika mouth widens, & salt water alters the brackish nature of the lagoon. The altered habitat will also stop the migration of birds from such far off places as Siberia, Manosarovar and Rann of Kutch.

On the whole, the ecological relationship between wildlife, vegetation birds, and fishes of the low lying coastal areas, lagoonal waters, tidal creeks, marshes etc. will be disrupted and the life cycle and existence of many species will come to an end.

A DARK FUTURE

Global warming and its accompanying hazards may never have been a threat, if no life existed on the planet. But mankind in his greed to exploit the resources of nature, has been creating hazards for himself, which are slowly emerging to be a Frankenstein monster. Thus apart from destroying nature, global warming will creep onto the very centre of man's life, disrupting his social and economic systems. As the coastal tracts are drained down by water, not only will coastal transportation systems be affected, but in the event of submergence of the coastal plains, evacuation & rehabilitation of the populace will cost much in terms of economic resources, simultaneously causing social upheavals.

The traditional relationship of rivalry and mutual dislike of the politically conscious people of the coastal plains (Cuttack, Puri and Balasore districts) and that of the rolling uplands and mountainous tracts dominated by tribes, is bound to erupt into civil unrest, as the people of the coastal plains encroach upon the tribal areas. The consequences of such encroachment may be the decimation of the tribals or the coastal people a scenario that is frightening to envision.

BLACK DAY FOR BLACK PAGODA

The famous Sun Temple at Konark was never made of black stones or painted black. Heavy rainfall and moist conditions led to the growth of moss and lichen on the stones. As the process continued, the whole temple, was completely covered with black vegetational accretion and thus came to be known as the Black Pagoda.

Experts agree that the Sun Temple has been subject to deterioration, primarily due to intrinsic factors. But it cannot be denied that environmental factors have also played an important role in bringing the monument to this stage of decay. Weathering processes like chemical corrosion (hydration, hydrolysis, solution and bleaching), crystallization of soluble salts, abrasive action of sand bearing wind and biochemical processes (growth of moss and lichen) have had their share in the gradual destruction of the monument.

Dr.C.R.Das, of the Department of Chemistry, Ravenshaw College, an expert on corrosion and erosion, conducted experiments at Konark to study the nature and extent of environmental hazards to the monument. His study reveals that corrosion is most during the rainy season when humidity is high. Consequently, salt (chloride ion) present in the atmosphere gets dissolved in the rain water and then is deposited in the pores of the stones. This accelerates the corrosion procession, especially on the iron clamps used inside. Which in turn, instead of protecting the stones, promote their disintegration.

Dr. Das also observed that gases like Carbon dioxide, Sulphur dioxide, Oxides of Nitrogen etc. increase the corrosion/erosion rate. Factors like wind direction, aerosol content in the atmosphere and temperature gradient, also influence the rate of weathering. Surprisingly, Dr. Das has questioned the methods of preservation adopted by the A.S.I., making the protection of the monument a volatile issue.

However, what is required today is an all-out effort of protecting this cultural heritage of Orissa by Pooling together the resources of all experts. As a beginning the ambient air quality at Konark should be monitored, no industries should be set up near the temple & a green belt should be created around the temple, to decrease the effects of atmospheric pollution.

POLITICS OF ATMOSPHERE

The life and development of 5.3 billion strong world population with a $13 trillion economy is not sustainable on the earth. The world population is to reach 6.25 billion by 2000 AD and 8.47 billion by 2025 AD, until it stabilizes around 12.4 billion by 2085 AD. Over the next half century the world economy is expected to increase 5 times. With the present technologies of energy production, low energy use efficiency, and technologies of food, housing and other national goods production, it is impossible to fulfill the needs of such a large population without impairing the earth system.The increased emissions into the atmosphere, the 'over harvesting' of the renewable resources (agricultural soils, marine resources, forests, ground water and bio-diversity), and the ejection of pollutions into the land and the sea beyond the nature's cleaning potential, have triggered off processes leading to the collapse of the earth system.

While the forests, soils and the oceans remove 4.8 billion tonnes of equivalents of Co_2 from the atmosphere every year, the anthropogenic emission of Co_2 is 8.5 billion tonnes of carbon equivalent, thus annually adding to the atmosphere a net excess amount of 3.7 billion tonnes of carbon equivalents of Co_2. The annual addition of CFC gas to the atmosphere is 772 million tonnes (equivalent to 1.4 billion tonnes of carbon units of CO_2). Nature has no capacity to absorb CFC.

Table - 11 : Top Carbon Emitters

Sl.No.	Name of the Country	'000 Tonnes of carbon equivalent	% of global emission	% of population
01.	Brazil	1,253,540	15.22	2.85
02.	USA	1,227,600	14.90	4.73
03.	USSR	1,034,100	12.55	5.46
04.	China	596,110	7.23	21.53
05.	India	294,900	3.58	16.18
06.	Unified Germany	271,300	3.29	1.46
07.	Indonesia	254,900	3.09	3.42
08.	Japan	247,524	3.00	2.34
09.	U.K.	156,900	1.90	1.08
10.	Myamer	151,489	1.84	0.79
11.	Columbia	133,950	1.62	0.60
12.	Poland	128,700	1.56	0.73
13.	Mexico	113,600	1.38	1.68
14.	Canada	110,100	1.34	0.50
15.	Thailand	109,500	1.33	1.06
16.	Italy	101,900	1.24	1.09
17.	Cote d'Ivoir	101,389	1.23	0.24
18.	France	94,200	1.14	1.07
	World total	6,381,702	100.00	100.00

Table - 12 : Top Methane Emitters

Sl.No.	Name of the countries	'000 tonnes of CH_4	'000 tonnes of carbon equivalent	% of total world emission
01.	USA	42,210	790,285.48	16.5
02.	India	30,810	576,846.62	12.0
03.	China	29,100	544,830.79	11.4
04.	USSR	19,120	357,978.17	7.5
05.	Canada	10,410	194.903.38	4.1
06.	Brazil	8,857	165,827 02	3.5
07.	Mexico	6,244	116,904.59	2.4
08.	Bangladesh	6,230	116,642.47	2.4
09.	Indonesia	6,119	114,564.25	2.39
10.	Thailand	5,090	95,298.58	1.99
11.	Saudi Arabia	4,885	91,460.43	1.91
12.	Australia	4,392	82,230.13	1.72
13.	U.K.	4,390	82,192.69	1.72
14.	France	4,189	78,429.42	1.64
15.	Japan	3,940	73,767.47	1.54
16.	Algeria	3,902	73,056.00	1.53
17.	Argentina	3,730	69,835.70	1.46
18.	Vietnam	3,188	59,687.99	1.24
19.	Netherlands	2,840	53,172.49	1.11
20.	Myamer	2,839	53,153.77	1.11
	World Total	2,55,610	4,785,711.00	100.00

Twenty years back a club of Rome publication the "Limits of Growth" had shocked the world in predicting that the unit of growth on earth would be reached in only one hundred years. The club of Rome's recent publication "Beyond the Limits" is still more alarming. The authors Donella H. Meadows, Denise L.Meadows, and Jorgen Randers have claimed that the earth system is all set to collapse in a few decades because of excess emissions into the air, over-harvesting of renewable resources and profuse ejection of pollutants into the land and sea much beyond the nature's renewal and cleaning capacities. The authors, however, hope that a sustainable earth is still technologically and economically feasible, provided national governments, international agencies, environmentalists and the people join their efforts in the gigantic reconstruction activities. The time span is too short and the list of measures to be implemented is too long. The first and foremost thing is the political will and commitment.

Table - 13 : Top CFC Emitting Countries

Sl.No	Name of the Country	'000 tonnes of carbon equivalent	% of total emission
01.	USA	350,000	25.8
02.	USSR	180,000	13.2
03.	Japan	100,000	7.4
04.	United Germany	95,000	7.0
05.	U.K.	71,000	5.2
06.	Italy	71,000	5.2
07.	France	69,000	5.1
08.	Spain	48,000	3.5
09.	Canada	36,000	2.7
10.	China	32,000	2.4
	World Total	1,052,000	100.00

The attempt to reduce the threat of global warming, ozone depletion, and the collapse of the earth system has three approaches as it is understood and propagated. The first one is population control, so that the demand for energy, food, housing material and other goods would decrease. The second approach is to reduce the energy consumption and the materialistic needs of man and stress on aesthetic aspects of life. The third approach is to switch over to new pollution free and environmentally safe technologies of energy production, energy efficiency, food production, housing and other materials production. The first approach is impartial because most of the population of the world is confined to developing countries and the issue has a strong link with the socio-economic problems.

On the other hand, the percentage of their contribution to atmosphere is much less compared to the developed countries. Then, the agreement shifts to the second approach. But, the second approach has not gained any ground and the developed countries are not prepared to give up their lavish, materialistic and energy-intensive life styles. The third approach appears sound but the R & D costs and the switch over costs to the new pollution free and environmentally safe technologies are too high and thousands of billions of dollars will be needed. Besides, the technologically advanced countries should have liberal approach to transfer technologies to the underdeveloped and developing countries. .

Domestic Policies & Atmosphere : Since 49% of the global warning is due to energy sector, the energy policy resources are most important. The best solution is switch over to the non-fossil sources of energy e.g. hydro-electric power, solar photovolataic power, solar thermal power, wind power, tidal power & geothermal power sources. The second approach is to increase the efficiency of fossil-fuel power sources either by adopting better power generation process on by changing fuel types from coal and oil to gas. The efficiency of the coal fired power plants could be raised to 43% from 33% by changing over to fluidised bed combustion and coal gasification process. Instead of coal fired plants if gas fired plants are used for power generation then the efficiency could be raised to 45%. Use of electro- chemical process in fuel cells should also be used to generate at 40-70% efficiency. Adoption of co-generation could increase the efficiency upto 85%. In cogeneration the excess heat rejected by the power plants are used for other industrial process. The third approach is to increase the energy use efficiency and also its conservation in industry, transport, and houses.

The industrial and technology policy measures involves replacing CFC use technologies by non-CFC technologies, conserving energy in industry, and avoid setting up big industries in low lying coastal areas as well as in forest areas. The method of co-generation could be made compulsory for industries using boilers. 24% of the global warming is by industry section.

The housing policy is important because brick, cement, timber, and CFC using material goods are needed in construction of houses. Cement manufacture alone release 140 million metric tonnes of carbon equivalent of CO_2 to the atmosphere as in 1987. The wood and timber needed in houses cause deforestation. There are several insulating and other materials used in houses which use CFCs. There are millions of house less persons who need houses. The advanced countries have lavish and big houses. To think of modern houses, with air conditioning facility etc. for all mankind is impossible as it will cause CO_2 emission, CFC emission and deforestation.

Transport policy measures include increasing fuel economy of vehicles, reducing number of automobiles by resourting to mass transport using alternate energy in automobiles, and changing fuel types from oil to gas.

The conservation efforts must also be in a cooperative manner. High technology skills have to be used. Legislative measures are very effective in curbing activities and technologies that create global warming. It is also important to set finance and accounts policies. The United Nations System of National Accounts (SNA) includes forests of subsoil assets in model national balance sheets. The World Reserve Institute has developed a natural accounting procedure for Indonesia. All countries should introduce such accounting and auditing systems.

The policy on international cooperation must cover technology transfer, financial assistance for environmental programmes and sharing of scientific information between the advanced and poor countries.

ENVIRONMENTAL COLONIALISM

As far as the annual CH_4 emission per capita rates are concerned WRI indicates that while the global per capita emission is 0.05 metric tonnes of carbon equivalent, developed countries like USA, Australia, and Canada have had a high per capita CH_4 emission rates due to pipe line leakage. Also, the oil rich countries like Algeria, Saudi Arabia, Oman, Mexico, New Zealand, Baharin, Kuwait, Qatar etc. have high per capita CH_4 emission rates due to pipeline leakage.

The country wise emissions of CO_2 reveal that mostly the developed countries and a few developing countries contribute disproportionately with their populations. The USA with only 4.73% of world population contributes 14.9% of total Co_2 emission. USSR with 5.46% of population contributes, 12.55% of global emission.

Historical Responsibility : The industrialised and rich countries not only have high emission rates now but also have emitted copiously in the past 100 years of industrialisation. Since the beginning of industrial revolution (i.e. 1860 AD) till 1987, 181 billion metric tonnes carbon units of CO^2 had been added to the atmosphere by fossil fuel burning the profits of which has gone to the industrial nations alone. During the same time 241 billion tonnes carbon unit of CO_2 have been contributed because of landuse change i.e. deforestation. It is difficult to fix historical responsibility of deforestation.

The rich countries disown their historical liability of contributing to global warming and ozone depletion. They also do not want to curb their present and future emissions. In contrast they want the developing and poor nations to adopt austerity measures and would specifically want them to reduce fossil fuel use on which poor nations depend. Also, the poor countries are asked to stop rise in agricultural products which is their staple food, reduce their livestock population that support millions, reduce cement production thus preventing housing for their houseless and so on. The development of the developing and poorer nations are seen as a curse.

Thus what is demanded is more power plants in developed countries and trees in third world countries to clear the CO_2 emission of the power plants set up in the North. The North-South divide has clearly emerged onto the global climate issues.

The New Delhi based Centre for Science & Environment has taken up the cause of developing nations by questioning the WRI statistics. It has suggested just ways of sharing the global commons on the basis of population so that 'social justice' principle is brought into climate issues. It attempts to translate the 'Green Economics' consciousness into equitable sharing of global carbon dioxide and methane sinks. The global sinks available belong collectively to the human race. The path shown by CSE heralds a process of rethinking which must be taken up by environmentalists, NGOs, Governments, and planners. It has also enshrined the "Polluter should pay" principle into the sharing process. The IPSEP propagates sharing of sinks on the basis of person years.

It is natural that each nations budget of greenhouse gas emissions has to be calculated by taking into account its terrestrial sinks like vegetation and soils, sources of emission, population, levels of economic development, etc. The CSE line of approach seems more rational.

MONTREAL TO RIO

The Montreal protocol on Substances that Deplete the Ozone layer was signed in September 1987 by 24 countries which together accounted for more than 85% of global CFC use. Earlier the UNEP set up a coordinating committee to review scientific knowledge of ozone layer depletion. In 1985, the Vienna convention for the protection of the Ozone Layer was adopted which stressed the need for understanding the ozone depletion as well as regulations to control them. This Vienna convention formed the basis of the Montreal protocol. The protocol called for a number of restrictions and use.

In May 1989 the signatories to the Montreal protocol gathered at Helsinki to review the protocol goals. At the meeting the US presented a report outlining several chlorine phase-out scenarios and suggested phase outs of CFCs, halons, methyl chloroform and carbon tetrachloride by 2000 AD so as to keep the atmospheric chlorine levels in 2100 at 1985 level. This was endorsed by the Helsinki meeting.

This meeting forced the basis of renegotiations of the Montreal protocol provisions to accommodate interests of the developing countries. The meeting also discussed issues of technology transfer to developing countries and creation of an international fund to assist developing countries to switch over to non-CFC technologies. An open-ended group was set up to workout modalities of working of the international fund. Expert committees were also appointed to collect informations on the ozone layers and available technologies.

So far 60 countries and the EC have signed the protocol. A multilateral $160 million was set up in 1990. The Montreal protocol was opposed by India, China, Malaysia and other developing countries as some of the classes of the protocol discriminated against the developing countries and their development plans. India's argument was that the rate of CFC phase-out programmes must be commensurate with the per capita CFC uses of the ozone depleting substances. The developed countries with higher per capita CFC use should have the obligation to phase-out CFCs at faster rate than the developing countries having very low per capita use. Besides the developed countries being solely responsible for the ozone depletion should bear the full cost of switch-over to non-CFC technologies through-out the world. Further the conditions of technology transfer and financial aid for the switch over should not affect the development priorities.

In June 1990, a meeting of the signatories of the Montreal Protocol at London agreed to these objections raised by developing countries for the cause of which India fought and lobbied persistently. The amendments called "London amendments" will come into force when 20 countries will ratify them. South Africa became the 20th country when it ratified the amendments.

China signed the protocol last June and Malayasia followed it a few months later. But India refused to sign until the London amendments were ratified by the stipulated 20 countries. Then, during mid April 1992 the signatories met at Geneva to review the progress of Protocol objectives. The Geneva meeting decided to exclude essential uses (medicinal use, industrial aerosols, and clearing application in electronics) of ozone depleting substances from the phase out plan and also decided to advance phase out deadline from 2000 AD to 1995. They also decided to proportionately advance the 10 year grace period given to developing countries. India attended the meeting as a special invitee and suggested key amendments.

A task force of the Ministry of Industry, Govt of India have meticulously calculated that India will need 3,500 to Rs.6,000 crores ($1.4 billion to $2.4 billion) to switch over to ozone friendly non-CFC technologies. Initially, India will get $4.0 million from the international fund mainly to finance detailed studies on switch over costs, mechanisms and technologies to be adopted. But the need for such huge costs will pose a serious problem. On the otherhand, India's per capita CFC use is only 8.8 gms at present and not likely to exceed 20 gms by 1996 (the cut off year for freezing the consumption level), while the per capita CFC use of USA is 800 gms and in case of other developed countries it is equally high.

The mother Earth is everyones property and everyone needs to care for it.



Pix : Sanjay K. Khatua.

CLIMATE CONVENTION : PROBLEMS & PROSPECTS

The Climate Change Convention, which came into existence at the Rio Summit, 1992, is an umbrella agreement which takes into account the cardinal principles on which actions to mitigate the causes of global warming are to be taken. However, by its very nature the Convention has major weaknesses - omission of specific actions or commitments that are applicable to the parties to the Convention. Hence, there will be several problems and pitfalls in the implementation of the Convention.

As per the Climate Change Convention, the developed countries will meet full incremental cost and provide technology for mitigation measures adopted by the developing countries. This principle appears simple in definition, but is extremely complex in interpretation. Undoubtedly, there are going to be several disputes on what constitutes the agreed full incremental cost.

The developed countries will prefer to view the introduction of new technologies merely as a case of mechanical quickfix. This is an extremely simplistic approach, because new, sophisticated technologies cannot work in the absence of appropriate infrastructure, skills and institutional arrangements.

The Tata Energy Research Institute (TERI) had organised a post -UNCED international seminar on "Environment and Development Policy Issues in Asia" in October 1992, in which one of the subjects was related to the "Climate Change Convention and its implementation". In the recommendations of the conference it was stated that, "There is a marked asymmetry between industrialised and developing countries in their respective capacity for formulating informed and cogent positions during the negotiating process. The asymmetry in capacity may have influenced the out-comes of the negotiations leading to the Rio agreements. The agreements themselves were negotiated in a relatively short period of time with the explicit objective of adoption at the UNCED. The whole process extended to a little more than a year. This was too short a period for building up institutional capacities in the several disciplines which are germane to formulating negotiating positions.

While the Climate Change Convention presents some daunting tasks to India, it also offers opportunities for questioning the very path of development that we have adopted, imitating the North. This path is neither sustainable nor feasible.

Countries like India cannot, for instance, continue with energy intensive forms of private transportation, that have typically become a part of American value system and lifestyle. We have to find public transport systems that do not result in proliferating demands for energy. Nor must we tolerate the inefficient equipment and appliances that are used in industry, agriculture and every household in the country.

The financing mechanisms that the Climate Change convention specifies, in principle, may help us receive finance as well as technology to implement a new pattern of development, which is sustainable and tolerable in terms of pollution levels, local and global. If this happens, the Climate Change Convention can, not only ward off the threat of global warming, but also provide India a means for sustainable progress, which has been the Indian tradition for centuries.